User's Guide

Part II

Life Scope TR

Bedside Monitor

BSM-6301/BSM-6501/BSM-6701

BSM-6000 series
BSM-6301A
BSM-6301K
BSM-6501A
BSM-6501K
BSM-6701A
BSM-6701K

0614-901229G

NIHON KOHDEN

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Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Related Documentation

The BSM-6000 series Bedside Monitor comes with the following manuals in addition to the Operator's Manual.

User's Guide, Part I

Gives supplemental information on the operation of the bedside monitor.

User's Guide, Part II

Describes the features and settings of the monitoring parameters.

Administrator's Guide

Describes how to install the bedside monitor. It also explains about the password protected settings on the SYSTEM SETUP window and SYSTEM CONFIGURATION screen which only an administrator can change.

Service Manual

Describes information on servicing the bedside monitor. Only qualified service personnel can service the bedside monitor.

Safety Standards

The safety standard of this bedside monitor is classified as follows:

Type of protection against electrical shock: CLASS I EQUIPMENT (AC Powered)
Internally Powered EQUIPMENT (BATTERY Powered)

Degree of protection against electrical shock

Degree of protection against electrical shock

Defibrillator-proof type CF applied part

AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P and AY-673P:
ECG, Respiration (impedance and thermistor method), IBP, Temperature, SpO_2, CO_2, O_2, NIBP, BIS

AY-660P: ECG, Respiration (impedance method), IBP, Temperature, SpO_2, CO_2, NIBP

AA-672P and AA-674P: Respiration (thermistor method), IBP, Temperature, SpO_2, CO_2, O_2, BIS

CF applied part:

AY-631P, AY-633P, AY-651P, AY-653P, AY-661P, AY-663P, AY-671P, AY-673P, AA-672P and AA-674P: CO

Degree of protection against harmful ingress of water: IPX0 (non-protected)

Degree of safety of application in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE:

Equipment not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE

Mode of operation: CONTINUOUS OPERATION

Safety Information

This User's Guide only contains safety information related to monitoring parameters. Full information is in the BSM-6000A/K series Bedside Monitor Operator's Manual (code number: 0614-900685H).

WARNING

Do not diagnose a patient based on only part of the monitoring data on the bedside monitor or only on the data acquired by the bedside monitor. Overall judgement must be performed by a physician who understands the features, limitations and characteristics of the bedside monitor by reading this operator's manual thoroughly and by reading the biomedical signals acquired by other instruments.

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Use with an Electrosurgical Unit 1.44

General

To monitor ECG, attach disposable electrodes to the patient and connect them to the ECG/RESP socket on the input unit. Up to 12 leads can be monitored with arrhythmia analysis and ST level measurement.

NOTE

ECG monitoring using 10 electrodes is not available when an AY-660P input unit is used.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. In this case, set the <IMP RESP MEASURE> on the RESP/CO_2 window to OFF on the bedside monitor. For a patient that requires the respiration monitoring, measure the respiration by thermistor method.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.

For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

NOTE

When a line isolation monitor is used, noise from the line isolation monitor may resemble actual ECG waveforms on the bedside monitor and cause false heart rate alarms or no alarm at all.

Using the Output Signal from the ECG/BP OUT Socket

CAUTION

When using the output signal from the monitor as the synchronization signal for other equipment such as an IABP (intra-aortic balloon pump) or defibrillator:

- Set the timing of the IABP by checking the waveform on the IABP screen.
- Check the condition of the bedside monitor at all times. The output signal may become unstable.
- Check that the delay time of the output signal is within the range of the connected equipment.

CAUTION

Only a Nihon Kohden defibrillator can use the output signal from the monitor as a synchronization signal. Check that the delay time of the output signal (heart rate trigger 20 ms maximum) is within the range of the connected defibrillator.

NOTE

- Analog ECG, analog BP and heart rate trigger output are not available when an AY-660P input unit is used.
- The output signal from the ECG/BP OUT socket may become unstable in the following conditions.
  - Electrode is dry or detached.
  - Electrode lead is damaged or disconnected from the electrode.
  - Electrode lead is pulled.
  - AC interference or EMG noise superimposed.
  - Air bubbles or blood clog in the circuit for monitoring IBP.
  - Cord or cable is disconnected or damaged.
- All instruments which are to be connected to the ECG/BP OUTPUT socket must use a YJ-910P or YJ-920P ECG/BP output cable and comply with the IEC 60601-1 safety standard for medical equipment.

The following shows the delay time of the output signal.

Output Signal	Delay Time
ECG	20 ms
BP	40 ms
Heart rate trigger	20 ms

Preparing for ECG Monitoring

Preparation Flowchart

1. Select the electrode lead and electrodes.

2. Connect the electrode lead to the ECG connection cord and connect the ECG connection cord to the ECG/RESP socket on the input unit.

3. Attach the disposable electrodes to the patient and attach the electrode lead to the electrodes.

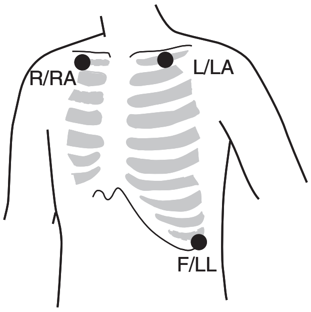
4. Monitoring starts. Set necessary settings.

Number of Electrodes and Measuring Leads

The leads which can be monitored differ according to the type of electrode lead and number of electrodes used. This monitor automatically identifies the number of electrodes attached to the patient.

No. of Electrodes	Lead	Features
3	I, II, III	Can measure at the thoracic wall.
6	I, II, III, aVR, aVL, aVF, two leads from V1 to V6	Similar to the standard 12 lead.
10	I, II, III, aVR, aVL, aVF, V1 to V6	Standard 12 lead.

Electrode Position

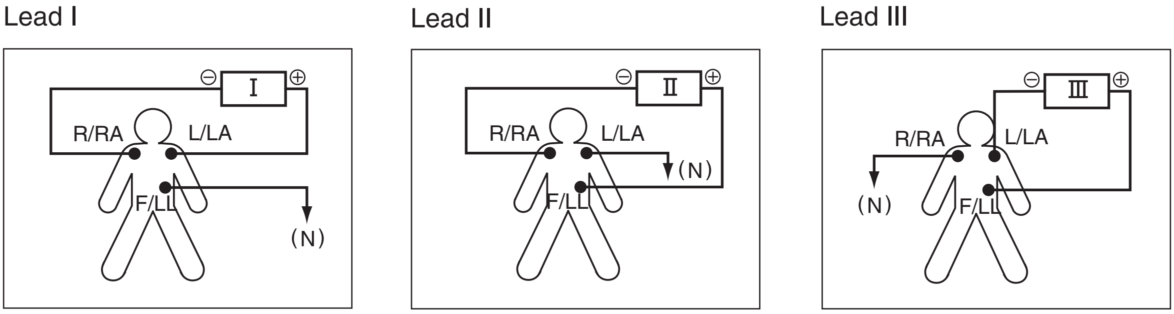


3 Electrode Leads

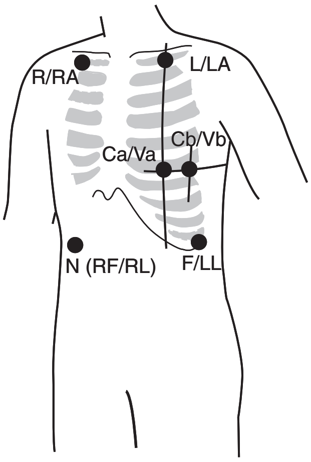
Electrode Position

Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Right infraclavicular fossa
L LA	Yellow (Yellow-beige) Black (Black-beige)	Left infraclavicular fossa
F LL	Green (Green-beige) Red (Red-beige)	Lowest rib on the left anterior axillary line

Lead Connection



6 Electrode Leads


R/RA
L/LA
Ca/Va
Cb/Vb
N (RF/RL)
F/LL

Electrode Position

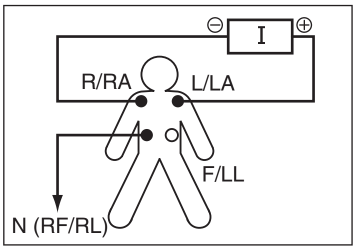
The 5-electrode method with lead II and lead V5 is effective for monitoring myocardial ischemia. You can improve monitoring accuracy considerably by adding lead V4 to this combination. Ca and Cb (Va and Vb) can be at any position of the standard 12 leads C1 to C6 (V1 to V6), but C4 and C5 (V4 and V5) are most appropriate for myocardial ischemic monitoring.

Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Right infraclavicular fossa
L LA	Yellow (Yellow-beige) Black (Black-beige)	Left infraclavicular fossa
F LL	Green (Green-beige) Red (Red-beige)	Lowest rib on the left anterior axillary line
N (RF) N (RL)	Black (Black-beige) Green (Green-beige)	Right anterior axillary line at the same level as F.
Ca Va	White (Brown-white) Brown (Blue-brown)	Fifth intercostal space on the left midclavicular line. (C4 position of standard 12 leads)
Cb Vb	White (Black-white) Brown (Orange-brown)	Left anterior axillary line at the same level as Ca. (C5 position of standard 12 leads)

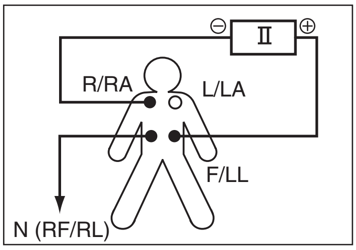
Lead Position

Standard limb leads

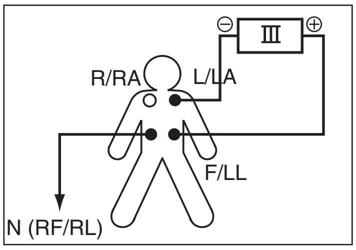
Lead I


⊖
I
⊕
R/RA
L/LA
F/LL
N (RF/RL)

Lead II

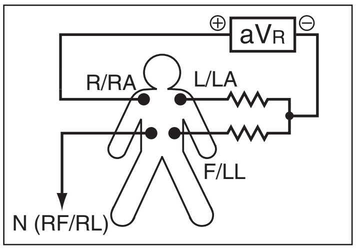

⊖
II
⊕
R/RA
L/LA
F/LL
N (RF/RL)

Lead III

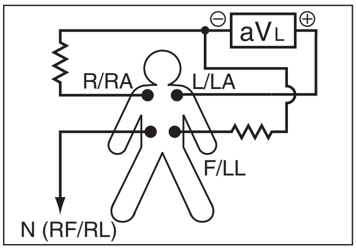

⊖
III
⊕
R/RA
L/LA
F/LL
N (RF/RL)

Monopolar limb leads

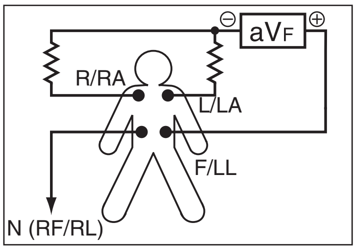
aVR lead


⊕
aVR
⊖
R/RA
L/LA
F/LL
N (RF/RL)

aVL lead

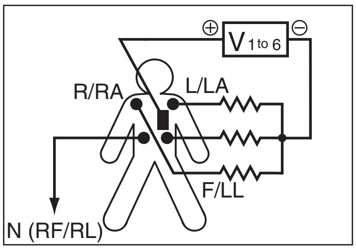

⊖
aVL
⊕
R/RA
L/LA
F/LL
N (RF/RL)

aVF lead


⊖
aVF
⊕
R/RA
L/LA
F/LL
N (RF/RL)

Monopolar chest leads

V1 to V6 leads

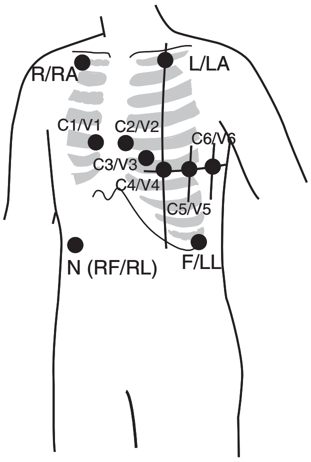

⊕
V1 to 6
⊖
R/RA
L/LA
F/LL
N (RF/RL)

Mason-Likar Modification

WARNING

Do not use 12 lead ECG interpretation results and measured values from the Mason-Likar modification for diagnosis because the limb electrode placement is not the same as the standard 12 lead ECG. This may cause wrong diagnosis since 12 lead ECG interpretation of this monitor is based on the standard 12 lead ECG.

The Mason-Likar modification places the four limb electrodes close to the shoulders and lower abdomen. The six C (V) electrodes are placed on the chest in the same position as the standard 12 lead ECG electrode placement. The waveforms acquired from the Mason-Likar modification are different from those of the standard 12 lead.



Electrode Position

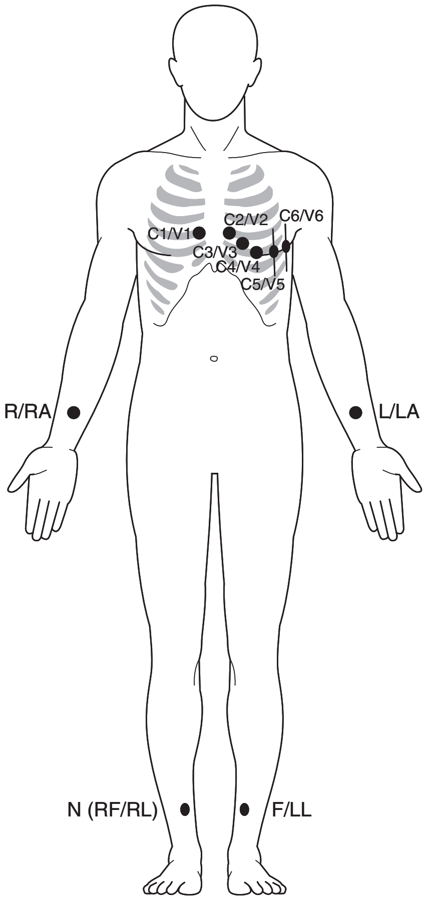
Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Right infraclavicular fossa
L LA	Yellow (Yellow-beige) Black (Black-beige)	Left infraclavicular fossa
F LL	Green (Green-beige) Red (Red-beige)	Lowest rib on the left anterior axillary line
N (RF) N (RL)	Black (Black-beige) Green (Green-beige)	Right anterior axillary line at the same level as F.
C1 V1	White (Red-white) Brown (Red-brown)	Fourth intercostal space at the right border of the sternum.
C2 V2	White (Yellow-white) Brown (Yellow-brown)	Fourth intercostal space at the left border of the sternum.
C3 V3	White (Green-white) Brown (Green-brown)	Halfway between C2 and C4.
C4 V4	White (Brown-white) Brown (Blue-brown)	Fifth intercostal space on the left midclavicular line.
C5 V5	White (Black-white) Brown (Orange-brown)	Left anterior axillary line at the same level as C4.
C6 V6	White (Purple-white) Brown (Purple-brown)	Left midaxillary line at the same level as C4.

Lead Connection

The lead connection is the same as the 6 electrode lead.

Standard 12 Leads

Electrode Position



Symbol	Lead Color (Clip Color)	Electrode Position
R RA	Red (Red-beige) White (White-beige)	Inside of right arm between the wrist and the elbow
L LA	Yellow (Yellow-beige) Black (Black-beige)	Inside of left arm between the wrist and the elbow
F LL	Green (Green-beige) Red (Red-beige)	Inside of the right calf between the knee and the ankle
N (RF) N (RL)	Black (Black-beige) Green (Green-beige)	Inside of the left calf between the knee and the ankle
C1 V1	White (Red-white) Brown (Red-brown)	Fourth intercostal space at the right border of the sternum.
C2 V2	White (Yellow-white) Brown (Yellow-brown)	Fourth intercostal space at the left border of the sternum.
C3 V3	White (Green-white) Brown (Green-brown)	Halfway between C2 and C4.
C4 V4	White (Brown-white) Brown (Blue-brown)	Fifth intercostal space on the left midclavicular line.
C5 V5	White (Black-white) Brown (Orange-brown)	Left anterior axillary line at the same level as C4.
C6 V6	White (Purple-white) Brown (Purple-brown)	Left midaxillary line at the same level as C4.

Lead Connection

The lead connection is the same as the 6 electrode lead.

Selecting Electrodes and Lead

Select the appropriate electrodes and lead according to the purpose.

WARNING

When using a defibrillator together with the monitor, use Ag/AgCl electrodes. Other types of electrodes, stainless steel in particular, will adversely affect the ECG waveform by slowing the baseline recovery on the monitor and result in no monitoring immediately following defibrillation.

CAUTION

Only use Nihon Kohden specified electrodes and electrode leads. When other type of electrodes or electrode leads are used, the “CHECK ELECTRODES” message may be displayed and ECG monitoring may stop.

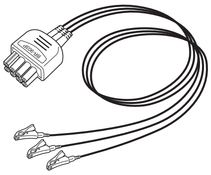
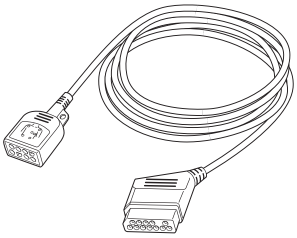
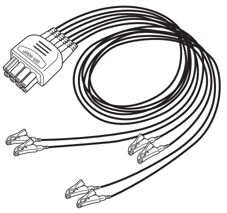
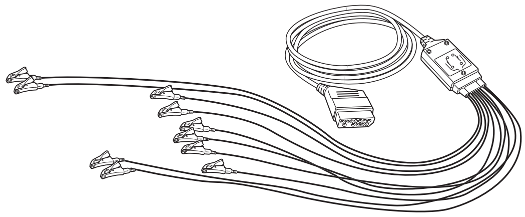
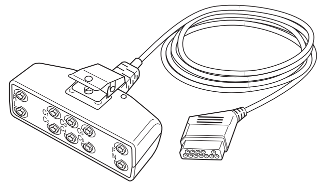
CAUTION

- When using the electrodes with DIN type lead, use only Vitrode V or N electrodes. If other electrodes are used, the electrode lead might not be properly connected and ECG monitoring may be unstable.
- Do not use electrodes of different metals. ECG monitoring may be unstable if electrodes of different metals are used.

NOTE

Electrode leads other than Nihon Kohden’s might not be defibrillator-proof.

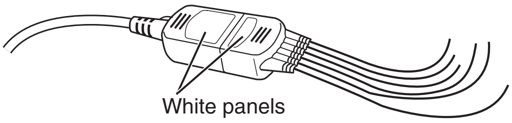
Types of Electrodes and Lead

No. of Electrodes	Disposable Electrodes	Electrode Lead	ECG Connection Cord
3 (I, II, III)	Vitrode L-150, L-150X, F-150M, F-150S	BR-903P (IEC)/BR-903PA (AHA) (Clip type, 0.8 m) 	JC-906P (IEC)/JC-906PA (AHA), 3 m 
	Disposable Electrode with DIN type lead, Vitrode V-090M3, V-09IO3, V-120S3, N-03IS3		
6 (I, II, III, aVR, aVL, aVF, 2 from V1 to V6)	Vitrode L-150, L-150X, F-150M, F-150S	BR-906P (IEC)/BR-906PA (AHA) (Clip type, 0.8 m) 	
	Disposable Electrode with DIN type lead, Vitrode V-060M6, V-06IO6		
10 (I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6)	Vitrode L-150, L-150X, F-150M, F-150S	ECG Patient Cable BJ-900P (IEC)/BJ-900PA (AHA) 	
	Disposable Electrode with DIN type lead, Vitrode V-040M4, V-04IO4, V-060M6, V-06IO6		JC-900P (IEC)/ JC-900PA (AHA) 

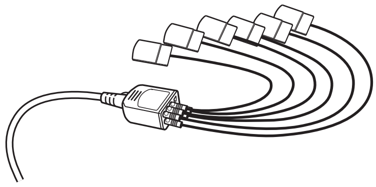
Connecting Cables and Attaching Disposable Electrodes

Connecting the Electrode Cable to the Input Unit

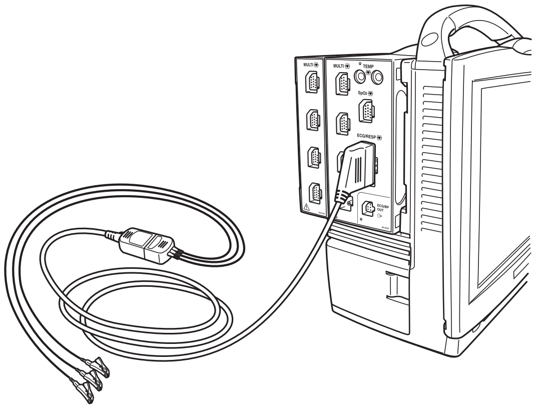
1. Connect the electrode lead and ECG connection cord so that their white panels face the same side.



When using the electrode with DIN type lead, connect the electrode lead of the electrode directly to the ECG connection cord according to the panel symbols.



2. Connect the ECG connection cord to the ECG/RESP socket on the input unit.



When connecting the 3-electrode lead

When using more than 3 electrodes with DIN type lead with JC-906P or JC-906PA ECG connection cord, the number of electrodes must be set on the OTHER page of the ECG window. Refer to the “Changing the Number of Electrodes” section.

Attaching Disposable Electrodes to the Patient

Attach the electrodes to the patient by referring to the manual provided with the electrodes.

WARNING

After attaching the electrode to the patient and connecting the cable to the monitor, check that electrodes are attached to the patient and check that the cable is connected to the monitor properly. When the electrodes are removed from the patient, do not touch the metal part of the electrode with bare hands or let the metal part of the electrode contact the metal part of the bed or any other conductive parts. Failure to follow this warning may cause electrical shock or injury to the patient by discharged energy.

CAUTION

Do not reuse disposable electrodes.

NOTE

- To maintain good contact between the electrode and skin, check that the paste of the disposable electrode is not dry.
- When contact of the disposable electrode becomes poor, replace the electrode with a new one immediately. Otherwise, contact impedance between the skin and electrode increases and the correct ECG cannot be obtained.

To obtain a stable ECG:

- Shave excess hair.
- Rub the patient’s skin with a piece of cotton where the electrodes are to be attached.
- If the skin is dirty, clean with soap and water. Dry completely.
- Clean the patient’s skin with a piece of cotton moistened with alcohol. Dry completely.

Monitoring ECG

When electrodes are attached to the patient and cables are connected properly, ECG and heart rate appear on the screen. The monitor automatically learns the patient's dominant ECG.

One lead appears on the home screen. Up to three leads can be displayed on the home screen when monitoring with six or ten leads. You can display eight leads on the 12 LEAD window when monitoring with six electrodes and twelve leads when monitoring with ten electrodes. To perform 12 lead ECG interpretation, ECG must be monitored with ten electrodes. For details about the 12 lead ECG interpretation, refer to Operator's Manual or Section 7 of the User's Guide Part I.

The number of traces to be displayed on the home screen can be set on the DISPLAY window. Refer to "Changing Settings for Home Screen" in Operator's Manual or Section 4 of the User's Guide Part I.

CAUTION

When the "CHECK ELECTRODE" message is displayed, ECG is not monitored properly and the ECG alarm does not function. Check the electrode, electrode leads and connection cord, and if necessary, replace with new ones.

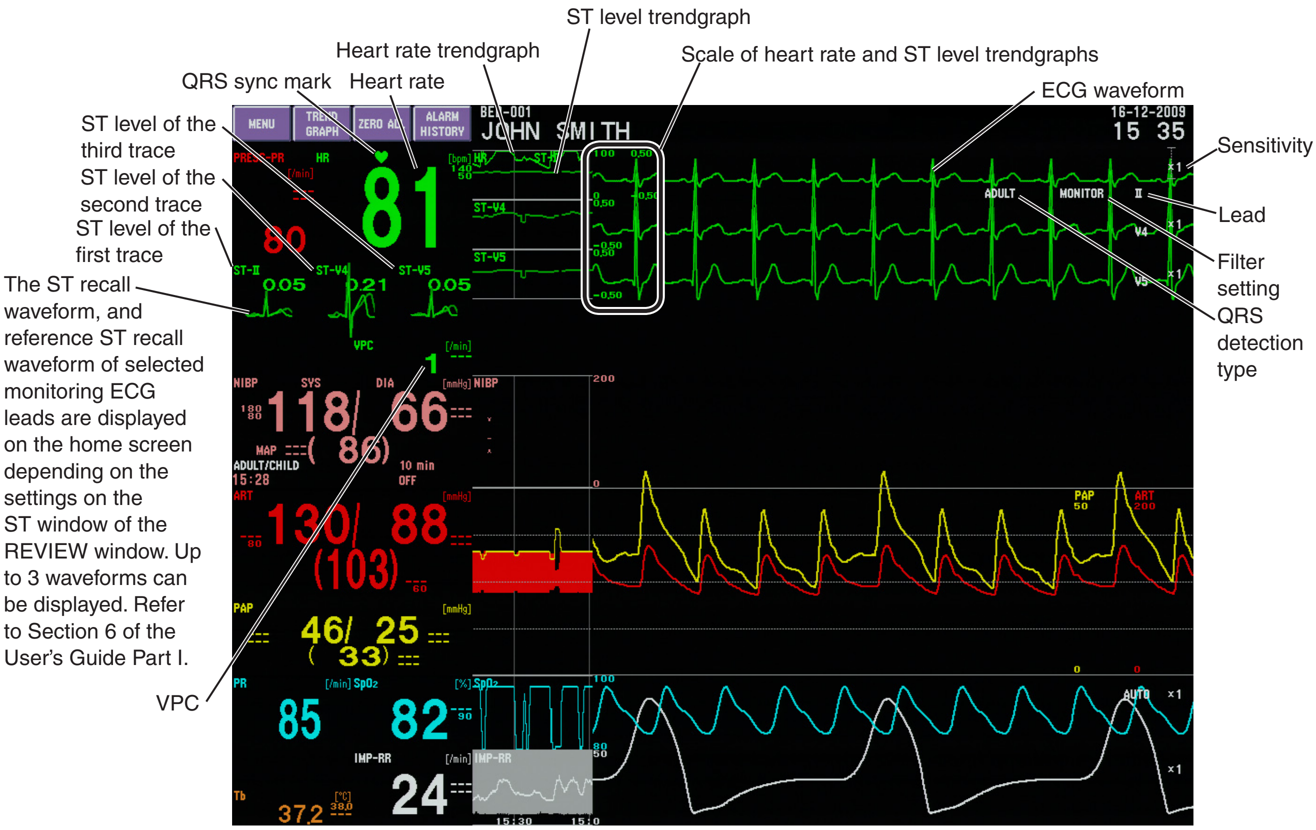
CAUTION

When the "NOISE" or "CANNOT ANALYZE" message is displayed, ECG data and alarm are not reliable. Remove the cause by checking the electrodes, electrode leads, patient's body movement, EMG and peripheral instruments grounding. Also make sure that an electric blanket is not used.

NOTE

- After adjusting the sensitivity of the ECG on the screen and changing necessary settings, check that the dominant QRS is appropriate.
- The maximum heart rate range is 300 beats/min. "300" is displayed on the screen even when the patient's heart rate is above 300.

ECG Information on the Home Screen


ST level trendgraph
Heart rate trendgraph
Scale of heart rate and ST level trendgraphs
QRS sync mark
Heart rate
ECG waveform
ST level of the third trace
ST level of the second trace
ST level of the first trace
Sensitivity
Lead
Filter setting
QRS detection type
VPC

The ST recall waveform, and reference ST recall waveform of selected monitoring ECG leads are displayed on the home screen depending on the settings on the ST window of the REVIEW window. Up to 3 waveforms can be displayed. Refer to Section 6 of the User's Guide Part I.

ECG Data Display

The following ECG related data is acquired when ECG is monitored.

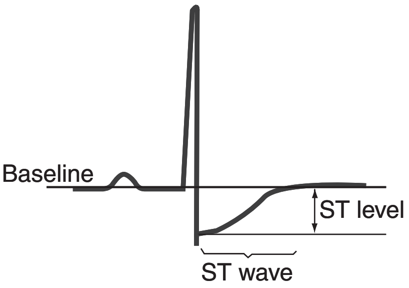
Screen/Window	Displayed Data	
	<ARRHYTHMIA ANALYSIS> is set to ON*[1]	**<ARRHYTHMIA ANALYSIS> is set to OFF***[1]
Home screen	Heart rate ST level Arrhythmia classification message Number of VPC per minute Arrhythmia alarm occurrence (when arrhythmia alarm is set to ON*[2])	Heart rate ST level "ASYSTOLE" alarm occurrence
TREND window (Refer to Operator's Manual or Section 6 of the User's Guide Part I)	Heart rate trendgraph ST level trendgraph Number of VPC trendgraph Heart rate list ST level list Number of VPC list	Heart rate trendgraph ST level trendgraph Heart rate list ST level list
ARRHYTHMIA RECALL window (Refer to Operator's Manual or Section 6 of the User's Guide Part I)	Recall files of the arrhythmias set to be saved*[3]	"ASYSTOLE" recall files
ST RECALL window (Refer to Operator's Manual or Section 6 of the User's Guide Part I)	ST recall files	ST recall files

*[1] Arrhythmia analysis can be turned on or off on the ECG window → ARRHYTH ANALYSIS page.

*[2] Alarm on/off and threshold can be set individually for certain arrhythmias on the ARRHYTH page on the ECG window or ARRHYTH ALARMS window.
When alarm recording is turned on, the data and waveform are recorded at the arrhythmia alarm occurrence.

*[3] The arrhythmia waveforms to be saved as recall files are set on the RECALL window of the Review window.

Measuring ST Level



The ST level is the amplitude between the baseline and ST wave. The ECG waveform is averaged for 15 seconds to remove artifacts. The baseline and the ST wave are detected from the averaged ECG, and the ST level is measured.

NOTE

- If there are too many arrhythmias, there is noise on the ECG, or the heart rate is below 32, ST level might not be measured and ST level is not displayed on the screen.
- Although the ST algorithm has been tested for accuracy of the ST analysis result, the significance of the ST level changes need to be determined only by a physician.

ST levels of up to 12 leads can be displayed on the ST window of the Review window. Refer to “ST Recall Window” in Operator’s Manual or Section 6 of the User’s Guide Part I.

You can change the ISO point, J point and ST point for ST level measurement on the ECG window → ST POINT page. Refer to the “Changing the ST Level Measurement Condition” section.

Monitoring Arrhythmia

General

The following functions are available for arrhythmia monitoring.

- Arrhythmia alarm indication (alarm sound, screen message and alarm indicator lamp). Refer to Operator's Manual or Section 5 of the User's Guide Part I.
- Arrhythmia waveform storage (Arrhythmia recall files). Refer to Operator's Manual or Section 6 of the User's Guide Part I.
- Arrhythmia waveform recording. Refer to Operator's Manual or Section 10 of the User's Guide Part I.
- VPC display and trendgraph. Refer to Operator's Manual or Section 4 and 6 of the User's Guide Part I.

WARNING

For arrhythmia monitoring, set <ARRHYTHMIA ANALYSIS> on the ECG window to ON. Otherwise, there is no sound or indication for arrhythmia alarms (except for ASYSTOLE).

When arrhythmia analysis is set to on, arrhythmia analysis starts as soon as the ECG monitoring starts. The monitor automatically detects and classifies arrhythmia by comparing each beat of the real-time ECG waveform to a reference ECG waveform (dominant QRS). If the following points of a QRS do not match the dominant QRS, that QRS is recognized as an arrhythmia.

- RR interval
- QRS width
- QRS amplitude
- QRS polarity

It is important to check the dominant QRS on the ECG window at the start of ECG monitoring for accurate arrhythmia monitoring.

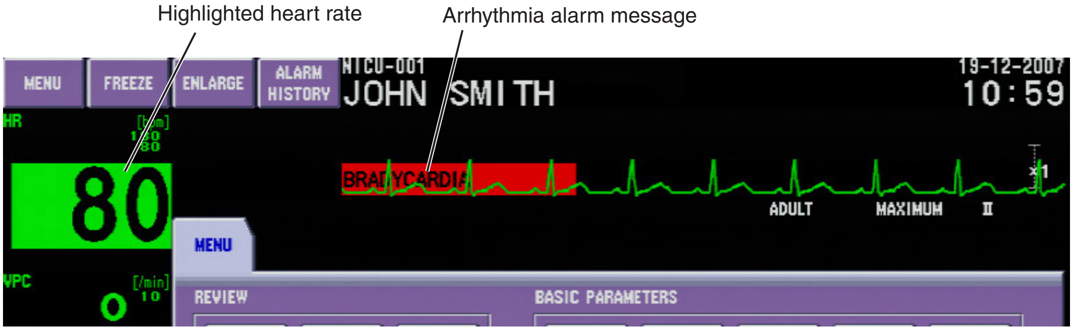
CAUTION

At the start of ECG monitoring, check that the dominant QRS is appropriate. Otherwise arrhythmia monitoring may be inaccurate.

When the QRS wave or RR interval changes too frequently, it becomes difficult for the monitor to distinguish between the normal ECG and arrhythmia. To solve this problem, the monitor uses pattern matching and multi template matching for analyzing arrhythmia. However, when the patient's QRS changes rapidly, check that the appropriate dominant QRS is used for arrhythmia analysis.

Arrhythmia Analysis Data Display

When the monitor detects an arrhythmia, the arrhythmia alarm and data are indicated. The message display interval depends on the priority setting on the ALARM SETTINGS window. For details on this setting, refer to Section 3-2 of the Administrator’s Guide.



The following arrhythmias are analyzed.

Arrhythmia name	Description
ASYSTOLE	Longer than 3 to 10 seconds (selectable) with no QRS complex.
VF	Ventricular fibrillation longer than 4 seconds.
VT	Ventricular tachycardia. 3 to 9 (selectable) or more consecutive VPCs when heart rate exceeding the VT heart rate limit (16 to 300 beats/min selectable).
EXT TACHY[*1]	Extreme tachycardia exceeding the EXTREME TACHY limit.
EXT BRADY[*1]	Extreme bradycardia dropping below the EXTREME BRADY limit.
VPC RUN	VPC short run. 3 to 8 (selectable) consecutive VPCs when heart rate exceeding the VPC RUN heart rate limit (16 to 300 beats/min selectable).
V BRADY[*1]	Ventricular bradycardia. 3 or more consecutive VPCs when heart rate dropping below V BRADY heart rate limit (15 to 299 beats/min selectable).
SV TACHY[*1]	Supraventricular tachycardia. 3 to 9 (selectable) or more consecutive normal QRS of regular R-R interval when heart rate exceeding the SV TACHY heart rate limit (16 to 300 beats/min selectable).
TACHYCARDIA	Heart rate above the upper heart rate limit.
BRADYCARDIA	Heart rate below the lower heart rate limit.
PAUSE[*1]	1 to 3 seconds (selectable) with no QRS.
COUPLET	VPC couplet (paired VPCs). 2 consecutive VPCs.
EARLY VPC	Early VPC including R-on-T type. VPC with a time interval from the preceding normal QRS complex of less than approximately one-third of the normal R-R interval, at heart rate dropping below 120[*2] beats/min.
MULTIFORM[*1]	Two different shaped VPCs within the last 3 minutes.
V RHYTHM[*1]	Ventricular rhythm. 3 or more consecutive VPCs.
BIGEMINY	Ventricular bigeminy. 3 or more consecutive pairs of VPC and normal QRS. A dominant rhythm of N-V-N-V-N-V (N = normal beat, V = ventricular beat)
TRIGEMINY[*1]	Ventricular trigeminy. A dominant rhythm of N-N-V-N-N-V.
FREQ VPC	Frequent VPCs. VPC rate (VPCs/min) reaching or exceeding the preset limit of 1 to 99 VPCs/min (selectable).
VPC	Ventricular premature contraction.
IRREGULAR RR[*1]	Consistently irregular R-R intervals.
PROLONGED RR[*1]	R-R interval 1.75 times longer than the dominant R-R interval.
NO PACER PULSE[*1][*3]	No QRS and pacing pulse within the bradycardia limit. Oversensing.
PACER NON-CAPTURE[*1][*3]	No QRS from the preceding pacing pulse for the preset time interval (40 to 480 ms selectable). Non-capture.

[*1] These arrhythmias become available when “EXTENDED” is selected for <ARRHYTHMIA TYPE> on the SYSTEM SETUP screen. Refer to Section 3 of the Administrator’s Guide. The arrhythmia type setting is not available for the BSM-6000A series. For BSM-6000A series, arrhythmia type is STANDARD only.

*2 120 beats/min when <QRS DETECTION TYPE> is set to ADULT, 150 beats/min when <QRS DETECTION TYPE> is set to CHILD or NEONATE.

*3 Available only when pacing detection is set to ON.

NOTE

When “EXTENDED” is selected for arrhythmia type and the bedside monitor is connected to a central monitor network that has old software so that “EXTENDED” arrhythmias cannot be monitored, the “COMMUNICATION LOSS” message appears for the bedside monitor and the bedside monitor cannot be monitored on the central monitor.

The QRS is annotated as follows.

QRS Annotation	Description
N	Normal QRS complex
P	Paced QRS
V	Ventricular premature contraction
?	Impossible to classify or during learning.
—	Impossible to classify due to noise interference.

Changing Arrhythmia Monitoring Settings

Check the following settings for arrhythmia monitoring.

Turning Arrhythmia Analysis On or Off

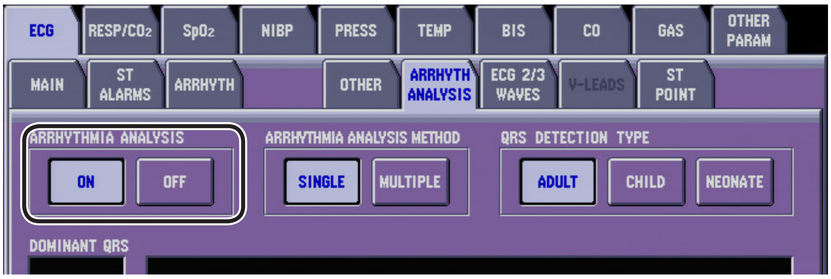
WARNING

For arrhythmia monitoring, set <ARRHYTHMIA ANALYSIS> on the ECG window to ON. Otherwise, there is no sound or indication for arrhythmia alarms (except for ASYSTOLE).

When arrhythmia monitoring is necessary, select ON.

1. Display the ARRHYTH ANALYSIS page of the ECG window.
   Press [Menu] key → ECG key → ARRHYTH ANALYSIS tab.

2. Select ON or OFF in the <ARRHYTHMIA ANALYSIS> box to turn arrhythmia analysis on or off.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
ARRHYTHMIA ANALYSIS
ON
OFF
ARRHYTHMIA ANALYSIS METHOD
SINGLE
MULTIPLE
QRS DETECTION TYPE
ADULT
CHILD
NEONATE
DOMINANT QRS

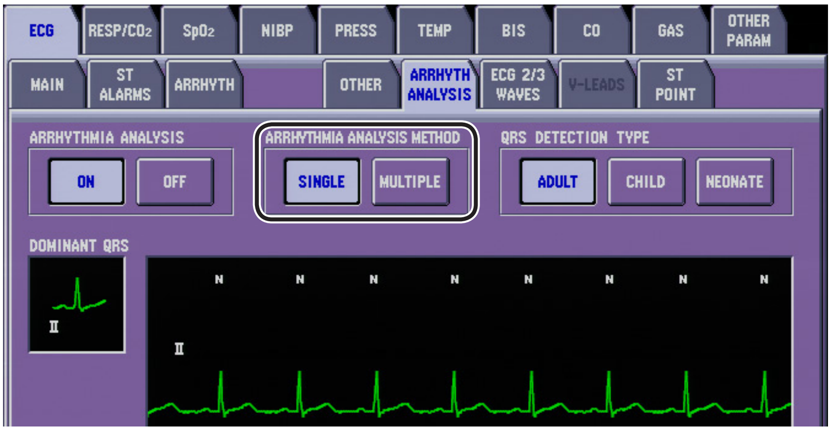
3. Press the [Home] key to return to the home screen.

Selecting Arrhythmia Analysis Leads

Select the leads for arrhythmia analysis.

1. Display the ARRHYTH ANALYSIS page of the ECG window.
   Press [Menu] key → ECG key → ARRHYTH ANALYSIS tab.

2. Select SINGLE or MULTIPLE in the <ARRHYTHMIA ANALYSIS METHOD> box to select analyzing leads.
   SINGLE: The lead selected for the first trace is analyzed.
   MULTIPLE: The leads selected for the first and second traces are analyzed.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
ARRHYTHMIA ANALYSIS
ON
OFF
ARRHYTHMIA ANALYSIS METHOD
SINGLE
MULTIPLE
QRS DETECTION TYPE
ADULT
CHILD
NEONATE
DOMINANT QRS
II
N N N N N N N N
II

3. Press the [Home] key to return to the home screen.

Selecting the Patient Type for QRS Detection

> **CAUTION**
>
> At the start of ECG monitoring, check that the correct patient type is set for <QRS DETECTION TYPE> on the ARRHYTH ANALYSIS page of the ECG window. If an inappropriate patient type is set, heart rate cannot be counted accurately and noise or P waves may be counted as QRS and cardiac arrest may be overlooked.

Select the monitoring patient type. The selected patient type is displayed on the home screen.

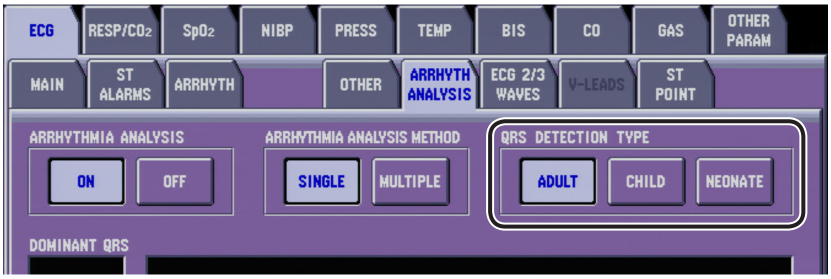
- When <AUTO ADMIT> in the TRANSPORT window of the SYSTEM CONFIGURATION screen is set to ON, this QRS detection patient type setting returns to the master setting on the ARRHYTH page of the MASTER window 30 minutes after the monitor power is turned off.
- When <AUTO ADMIT> in the TRANSPORT window of the SYSTEM CONFIGURATION screen is set to OFF, you can select whether to save the settings or initialize the master settings. Refer to Section 3 of the Administrator's Guide.

The QRS settings depend on the patient type.

Items	**QRS DETECTION TYPE Setting**		
	ADULT	**CHILD**	**NEONATE**
Detect narrow QRS	Not available	Not available	Available
QRS detection sensitivity	Automatic sensitivity	Same as the <SENSITIVITY> setting	Automatic sensitivity
Default setting of ISO point	R – 80 ms	R – 56 ms	
Default setting of J point	R + 48 ms	Cannot be set	
Default setting of ST point	J + 60 ms	R + 60 ms	

1. Display the ARRHYTH ANALYSIS page of the ECG window.
   Press [Menu] key → ECG key → ARRHYTH ANALYSIS tab.

2. Select the patient type in the <QRS DETECTION TYPE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
ARRHYTHMIA ANALYSIS
ON
OFF
ARRHYTHMIA ANALYSIS METHOD
SINGLE
MULTIPLE
QRS DETECTION TYPE
ADULT
CHILD
NEONATE
DOMINANT QRS

3. Press the [Home] key to return to the home screen.

Learning the ECG Waveform for Arrhythmia Detection (VPC Learning)

The monitor automatically detects and classifies arrhythmia waveforms when arrhythmia analysis is set to on. To do this, the monitor compares each beat of the real-time ECG waveform to a reference ECG waveform (dominant QRS).

The monitor automatically samples this reference waveform when ECG monitoring begins, when the monitoring lead is changed, when the “CHECK ELECTRODES” alarm message is resolved or <PACING DETECT> setting is changed. Sampling the reference waveform is called “Learning”.

Learning takes a few seconds. During learning, a “LEARNING” message is displayed on the screen. After learning, the dominant QRS is replaced with the new one and the monitor resumes analyzing the ECG waveforms.

NOTE

- To make the monitor learn, <ARRHYTHMIA ANALYSIS> on the ARRHYTH ANALYSIS page of the ECG window must be set to ON.
- During learning, alarms other than “ASYSTOLE”, “VF”, “BRADYCARDIA” and “TACHYCARDIA” do not function.

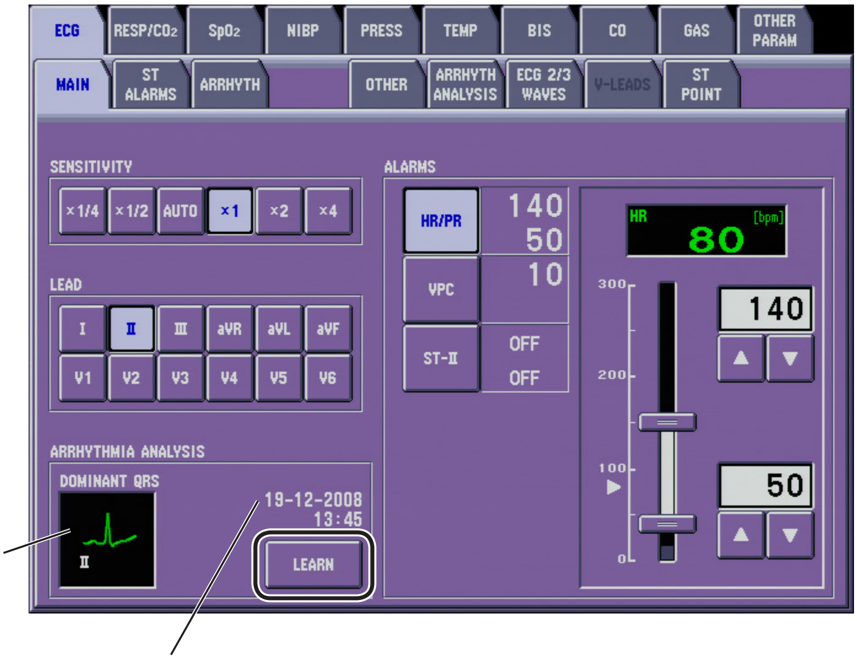
You can make the monitor “relearn” the reference ECG waveform at any time, for example, when the automatic VPC classification is questionable.

CAUTION

If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient’s ECG and check that the dominant QRS is appropriate. Otherwise, an important arrhythmia may be overlooked.

1. Display the MAIN or ARRHYTH ANALYSIS page of the ECG window. Press [Menu] key → ECG key → MAIN or ARRHYTH ANALYSIS tab.

2. Touch the LEARN key. The monitor learns the reference ECG waveform and the dominant QRS is refreshed.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ARRHYTHMIA ANALYSIS
DOMINANT QRS
II
19-12-2008
13:45
LEARN
ALARMS
HR/PR
140
50
10
VPC
ST-II
OFF
OFF
HR
[bpm]
80
300
200
100
0
140
50

Dominant QRS

Date and time the dominant QRS is acquired

3. Check that the dominant QRS is appropriate for arrhythmia analysis.

4. Press the [Home] key to return to the home screen.

Checking the Dominant QRS

The monitor detects QRS of the monitoring ECG and classifies them into templates. The monitor selects the most typical QRS, called dominant QRS, and uses it for analyzing arrhythmia. Whenever ECG is learned or relearned, the dominant QRS is refreshed.

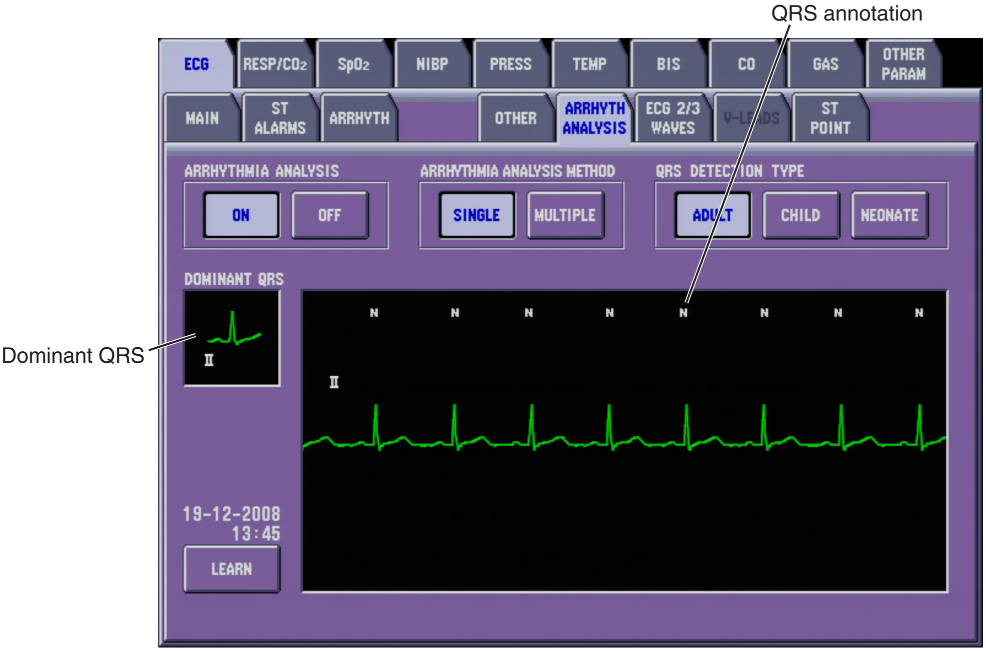
The ECG on the ARRHYTH ANALYSIS window are annotated by the following QRS classification.

QRS Annotation	Description
N	Normal QRS complex
P	Paced QRS
V	Ventricular premature contraction
?	Impossible to classify or during learning.
–	Impossible to classify due to noise interference.

If there is any doubt about the arrhythmia analysis, make the monitor relearn the patient’s ECG and check the dominant QRS.

1. Display the ARRHYTH ANALYSIS page of the ECG window.
   Press [Menu] key → ECG key → ARRHYTH ANALYSIS tab.

2. The dominant QRS and ECG of the first trace is displayed on the ARRHYTH ANALYSIS page.



QRS annotation

Dominant QRS

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
ARRHYTHMIA ANALYSIS
ON
OFF
ARRHYTHMIA ANALYSIS METHOD
SINGLE
MULTIPLE
QRS DETECTION TYPE
ADULT
CHILD
NEONATE
DOMINANT QRS
II
N N N N N N N N
II
19-12-2008
13:45
LEARN

NOTE

The ECG waveform on the ECG window is delayed 5 seconds.

3. Check that the dominant QRS is appropriate.

   To change the dominant QRS, touch the LEARN key to relearn the ECG. The dominant QRS is refreshed.

4. Press the [Home] key to return to the home screen.

Changing ECG Settings

Change settings on the ECG window. The following settings can be changed for ECG monitoring.

- Monitoring lead and lead name
- ECG sensitivity
- Number of ECG traces on the home screen
- Learn ECG. Refer to the “Monitoring Arrhythmia” section.
- Heart rate, arrhythmia and ST alarm limits and setting
- Arrhythmia analysis on or off. Refer to the “Monitoring Arrhythmia” section.
- Arrhythmia analysis lead. Refer to the “Monitoring Arrhythmia” section.
- Check dominant QRS. Refer to the “Monitoring Arrhythmia” section.
- ST level settings
- Pacing settings
- Number of electrodes
- Auto lead change on or off when electrode is detached
- Heart rate display mode
- Filter mode
- Hum filter on or off
- Sync source
- Sync sound pitch
- Pulse rate display on or off
- QRS detection type

The following items can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

- ECG electrode lead type (IEC or AHA)
- Heart rate sync sound pitch
- ECG display color
- Arrhythmia type (standard or extended)
  The arrhythmia type setting is not available for the BSM-6000A series. For BSM-6000A series, arrhythmia type is STANDARD only.

The ST level unit (mV or mm) can be set on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator’s Guide.

The scale of the heart rate and ST level trendgraphs on the home screen are the same scale as the trendgraphs of the Review window. Refer to Operator’s Manual or Section 6 of the User’s Guide Part I.

ST waveform and reference ST recall waveform display on the home screen can be set to ON or OFF. Refer to Section 6 of the User’s Guide Part I.

The ECG sweep speed is the speed set on the DISPLAY window. Refer to Section 3 of the User’s Guide Part I.

Changing the Monitoring Lead

One lead can be monitored with 3 electrodes and three leads can be monitored with 6 or 10 electrodes on the home screen.

No. of Electrodes	Lead
3	I, II, III
6	I, II, III, aVR, aVL, aVF, two leads from V1 to V6
10	I, II, III, aVR, aVL, aVF, V1 to V6

When monitoring with 6 or 10 electrodes, the lead of the first trace can be automatically changed to a stable lead when there is an electrode detachment or the "CHECK ELECTRODES" message is displayed for more than 5 seconds. Refer to the "Auto Lead Change On or Off" section.

Optimum Lead

NOTE

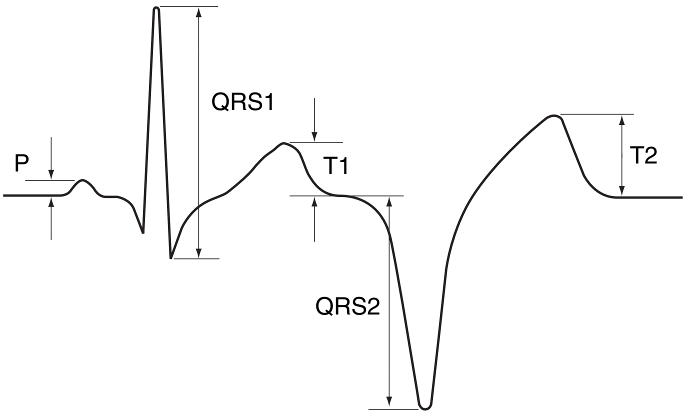
Follow the physician's instructions for lead position when available.

It is generally considered that Lead II and Lead V1 are suitable for arrhythmia monitoring and that Lead V4 and Lead V5 are suitable for myocardial ischemia monitoring.

Some types of ECGs are difficult for automatic analysis, and heart rate or arrhythmia detection level is not accurate for some patients. In these cases, use the following procedure to find the appropriate lead for automatic analysis.

1. Measure the patient's ECG with the standard 12 ECG leads using an ECG instrument.

2. Select the optimum lead according to the following guidelines:
   i) Select the lead with the highest QRS wave amplitude and least difference in amplitude compared with a VPC or pacing pulse.
   $0.5 \leq QRS1/QRS2 \leq 2$
   ii) Select the lead with less than 0.2 mV amplitude of the P-wave.
   $P \leq 0.2$ mV
   iii) Select the lead with a T-wave amplitude which is less than one-third of the QRS wave.
   $T1 \leq 1/3QRS1, T2 \leq 1/3QRS2$

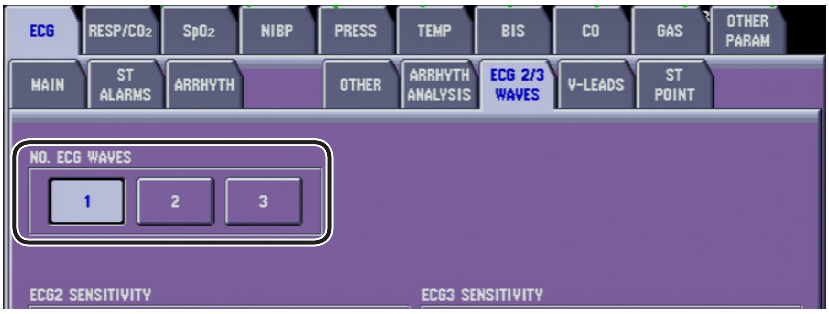


Selecting the Number of ECG Traces on the Home Screen

Select the number of ECG traces on the home screen. This setting can also be changed on the WAVES page of the DISPLAY window.

1. Display the ECG 2/3 WAVES page of the ECG window.
   Press [Menu] key → ECG key → ECG 2/3 WAVES tab.

2. Select the number of ECG traces from the <NO. ECG WAVES> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
NO. ECG WAVES
1
2
3
ECG2 SENSITIVITY
ECG3 SENSITIVITY

3. Press the [Home] key to return to the home screen.

Changing a Lead

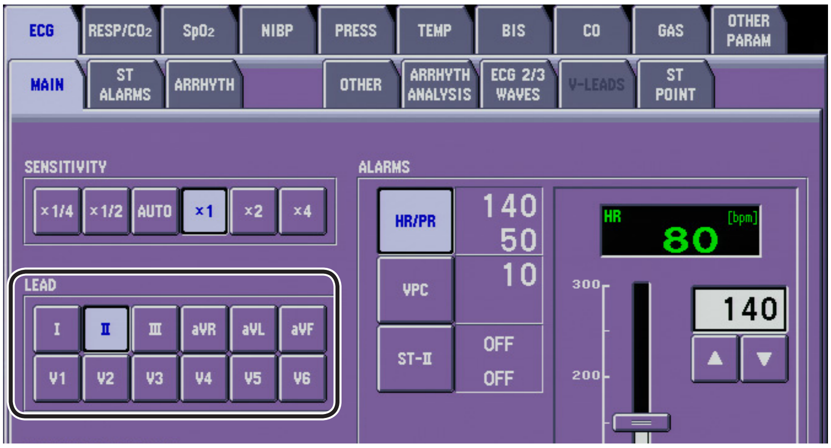
You can change the lead of traces on the home screen.

NOTE

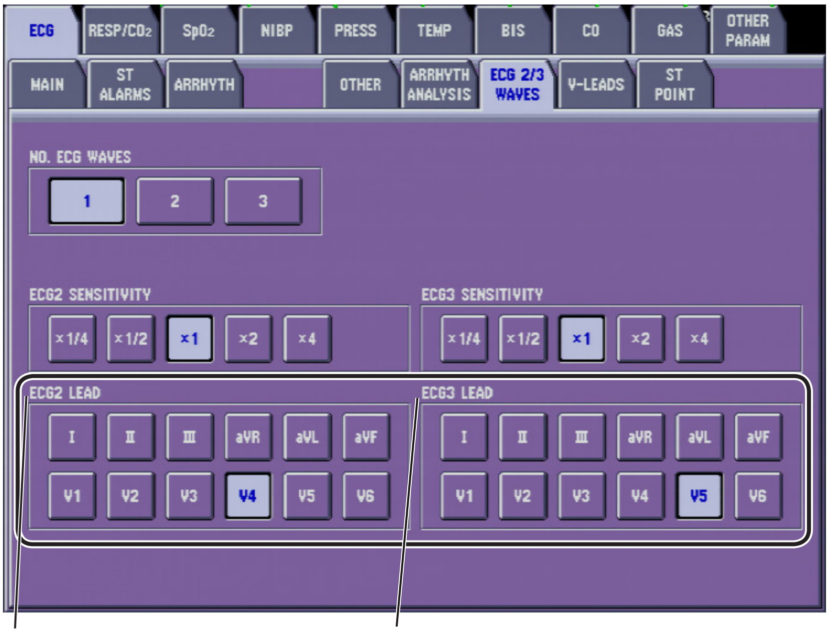
- When the lead is changed on the MAIN window, the lead on the ARRHYTH ANALYSIS window also changes.
- When the <NUMBER OF ELECTRODES> setting on the OTHER window is changed, the lead setting automatically changes to II. Change the number of electrodes setting before changing the lead.

1. Display the MAIN page of the ECG window.
   Press [Menu] key → ECG key → MAIN tab.

2. Select the lead from the <LEAD> box. The first trace changes to the selected lead.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ALARMS
HR/PR
140
50
VPC
10
ST-II
OFF
OFF
HR
[bpm]
80
300
200
140
▲
▼

To change the lead for the second and third traces on the home screen, touch the ECG2/3 WAVES tab and select the lead for each trace.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
NO. ECG WAVES
1
2
3
ECG2 SENSITIVITY
×1/4
×1/2
×1
×2
×4
ECG3 SENSITIVITY
×1/4
×1/2
×1
×2
×4
ECG2 LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ECG3 LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

For second trace

For third trace

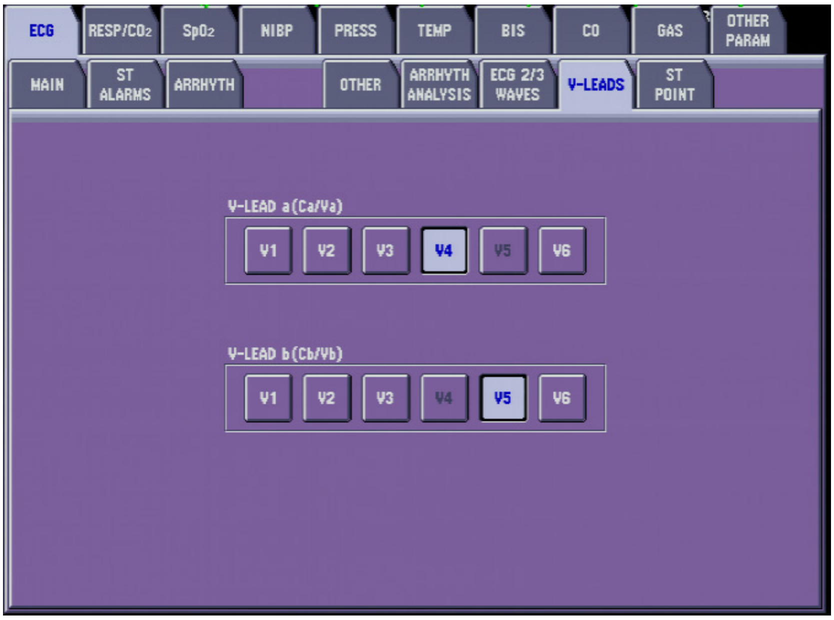
3. Press the [Home] key to return to the home screen.

Assigning Va and Vb (Ca and Cb) Leads when Monitoring with 6 Electrodes

You can assign the leads for Va and Vb when using 6 electrodes. After assigning the Va and Vb leads, select the monitoring lead.

1. Display the V-LEADS page of the ECG window.
   Press [Menu] key → ECG key → V-LEADS tab.

2. Select the lead by touching the desired lead key. The selected lead becomes available to be selected on the ECG2/3 WAVES window.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
V-LEAD a(Ca/Va)
V1
V2
V3
V4
V5
V6
V-LEAD b(Cb/Vb)
V1
V2
V3
V4
V5
V6

   If necessary, you can change the sensitivity for the second and third traces. Refer to the “Changing the ECG Sensitivity” section.

3. Press the [Home] key to return to the home screen.

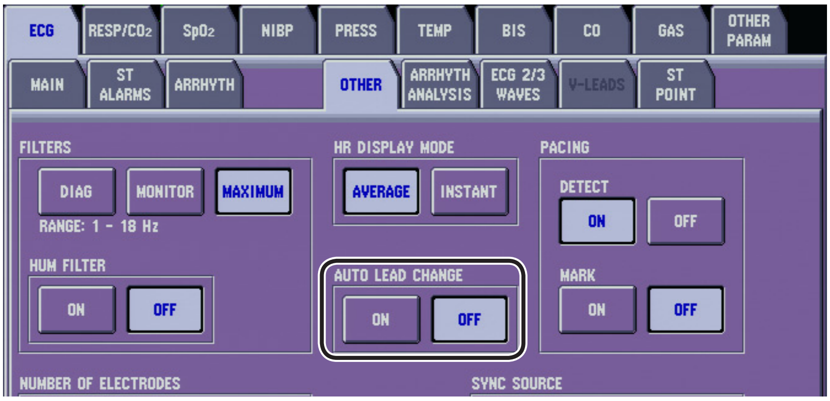
Auto Lead Change On or Off

When monitoring with 6 or 10 electrodes and <AUTO LEAD CHANGE> on the OTHER window is set to ON, the lead for the first trace on the home screen can be automatically changed to a stable lead when there is an electrode detachment or the "CHECK ELECTRODES" message is displayed for more than 5 seconds on the screen. While the "AUTO LEAD CHANGE" message is displayed, the "CHECK ELECTRODES" alarm message is not displayed.

Five seconds after the detached electrode or electrode lead is attached again, the lead of the first trace returns to the lead prior to auto lead change.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Select ON or OFF in the <AUTO LEAD CHANGE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF
NUMBER OF ELECTRODES
SYNC SOURCE

3. Press the [Home] key to return to the home screen.

Changing the ECG Sensitivity

The sensitivity determines the size of the waveform on both the screen and recording paper. For stable QRS detection, the QRS amplitude should be larger than 1 cm on the screen.

The sensitivity can be set manually or automatically. When you select auto sensitivity, the sensitivity is automatically determined according to the average QRS amplitude of the previous 16 beats. When sensitivity is set automatically, "AG" (auto gain) appears beside the sensitivity on the screen.

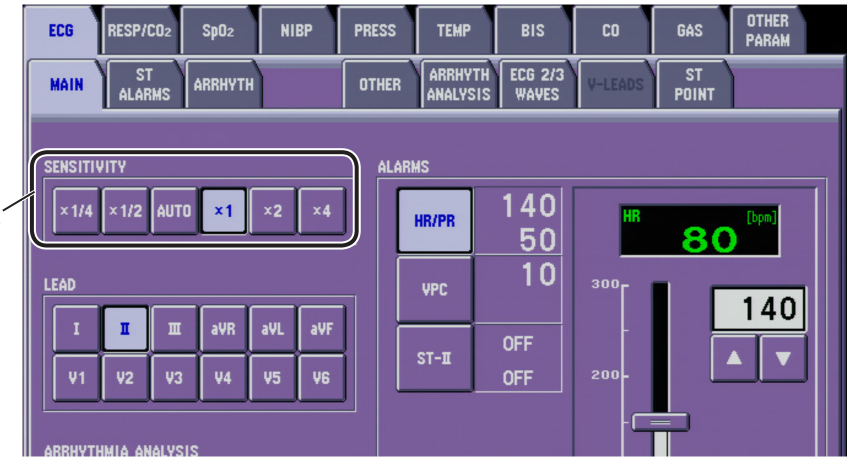
QRS Wave Amplitude	Auto Sensitivity
< 5 mm	× 4
< 10 mm	× 2
< 20 mm	× 1
< 30 mm	× 1/2
≥ 30 mm	× 1/4

NOTE

During learning or when there is noise, auto sensitivity is not possible.

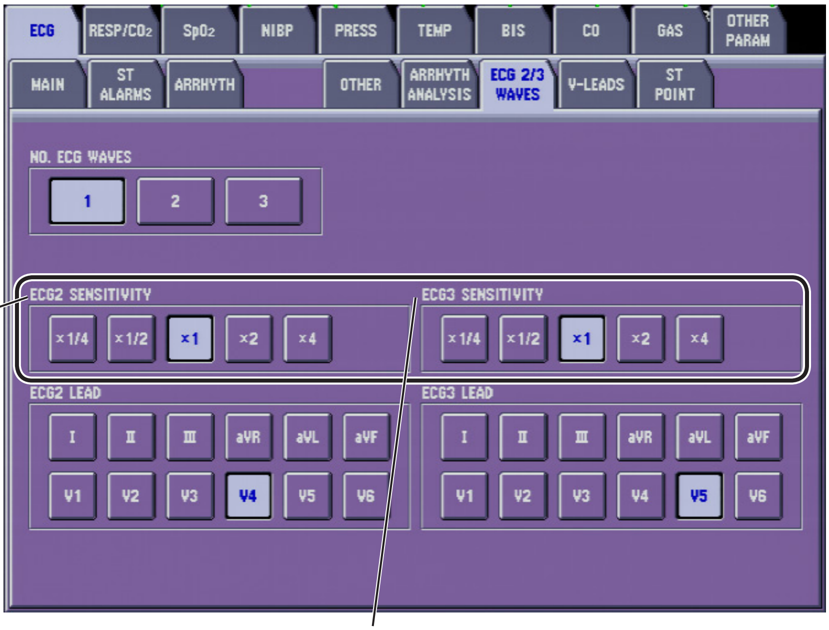
1. Display the MAIN page of the ECG window.
   Press [Menu] key → ECG key → MAIN tab.

2. Select the sensitivity from the <SENSITIVITY> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ALARMS
HR/PR
140
50
VPC
10
ST-II
OFF
OFF
HR
[bpm]
80
300
200
140
ARRHYTHMIA ANALYSIS

For first trace

To change the sensitivity for the second and third traces, display the ECG2/3 WAVES page and select the sensitivity from the <ECG2 SENSITIVITY> box for the second trace and the <ECG3 SENSITIVITY> box for the third trace.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
NO. ECG WAVES
1
2
3
ECG2 SENSITIVITY
×1/4
×1/2
×1
×2
×4
ECG3 SENSITIVITY
×1/4
×1/2
×1
×2
×4
ECG2 LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ECG3 LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

For second trace

For third trace

3. Press the [Home] key to return to the home screen.

Changing the Heart Rate/Pulse Rate, VPC and ST Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower heart rate/pulse rate, VPC and ST level of the first trace alarm limits on the ECG window. You can set all alarms, including the upper and lower heart rate alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

Setting Range

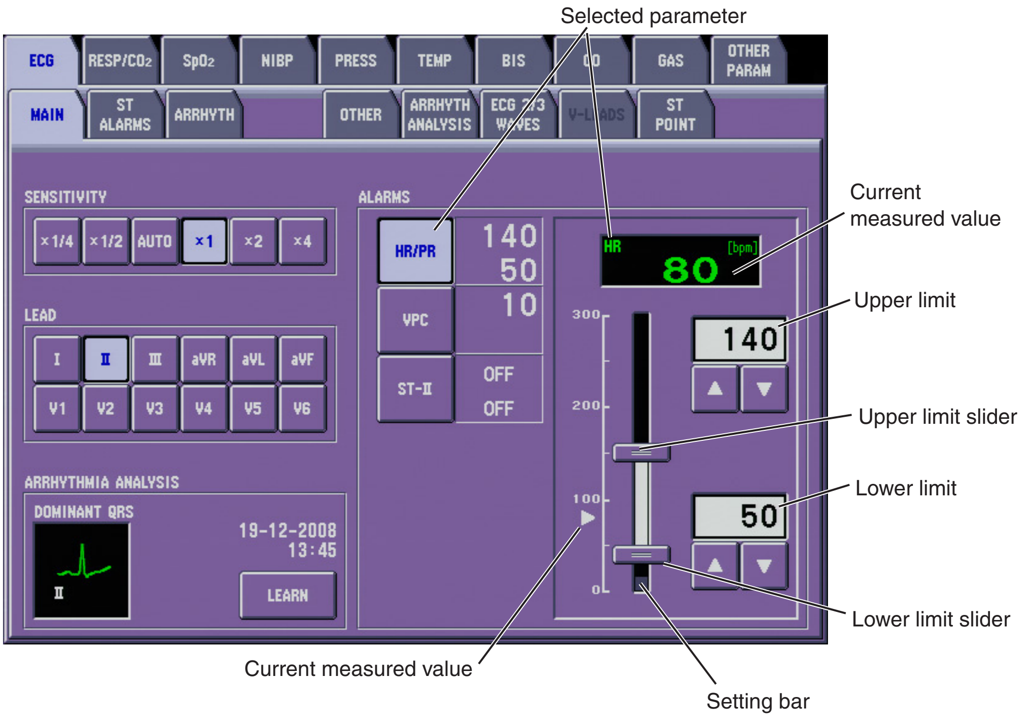
NOTE

VPC alarm limit can only be set when <ARRHYTHMIA ANALYSIS> on the ECG window is ON.

HR/PR:	Upper limit:	When <SYNC SOURCE> is set to ECG: 16 to 300 beats/min in 1 beat/min steps, OFF When <SYNC SOURCE> is set to PRESS or SpO_2: 31 to 250 beats/min in 1 beat/min steps, OFF (default setting: OR/ICU-140, NICU-200)
	Lower limit:	When <SYNC SOURCE> is set to ECG: OFF, 15 to 299 beats/min in 1 beat/min steps When <SYNC SOURCE> is set to PRESS or SpO_2: OFF, 30 to 249 beats/min in 1 beat/min steps (default setting: OR/ICU-50, NICU-100)
VPC:	Upper limit:	1 to 99 beats/min in 1 beats/min steps, OFF (default setting: OFF)
ST:	Upper limit:	–1.99 to +2.00 mV in 0.01 mV steps (–19.9 to +20.0 mm in 0.1 mm steps), OFF (default setting: OFF)
	Lower limit:	OFF, –2.00 to +1.99 mV in 0.01 mV steps (–20.0 to +19.9 mm in 0.1 mm steps) (default setting: OFF)

1. Display the MAIN page of the ECG window.
   Press [Menu] key → ECG key → MAIN tab.

2. Touch the HR/PR key to change the heart rate/pulse rate alarm limits.
   Touch the VPC key to change the VPC alarm limit.
   Touch the ST key to change the ST level of the first trace alarm limits.


Selected parameter
Current measured value
Upper limit
Upper limit slider
Lower limit
Lower limit slider
Current measured value
Setting bar
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 3/3 WAVES
V-LEADS
ST POINT
SENSITIVITY
×1/4
×1/2
AUTO
×1
×2
×4
LEAD
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
ARRHYTHMIA ANALYSIS
DOMINANT QRS
II
19-12-2008
13:45
LEARN
ALARMS
HR/PR
140
50
10
VPC
ST-II
OFF
OFF
HR
[bpm]
80
300
200
100
0
140
50

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Changing Arrhythmia Alarm Settings

WARNING

For arrhythmia monitoring, set <ARRHYTHMIA ANALYSIS> on the ECG window to ON. Otherwise, there is no sound or indication for arrhythmia alarms (except for ASYSTOLE).

CAUTION

When the alarm is turned OFF for an arrhythmia, there will be no alarm for that arrhythmia type. There is no message or mark to indicate that a certain arrhythmia alarm is turned off. Therefore, be careful when you turn off an arrhythmia alarm.

NOTE

When an arrhythmia alarm is turned OFF, there will be no alarm recording for that arrhythmia type even when alarm recording is set to ON on the RECORD window.

You can turn on or off the alarm for individual arrhythmias and set the threshold for some arrhythmias. The following table shows the setting for each arrhythmia.

Parameter	Detection Condition (Default Setting)	Alarm ON/OFF Setting
ASYSTOLE	3 to 10 seconds (OR, ICU: 5 s NICU: 3 s)	ON fixed
VF	—	ON fixed
VT	—	ON fixed
EXT TACHY*[1]	Upper heart rate alarm limit to 300 beats/min (OR, ICU: 160 NICU: 220)	ON/OFF (OFF)
EXT BRADY*[1]	15 to lower heart rate alarm limit (OR, ICU: 40 NICU: 80)	ON/OFF (OFF)
VPC RUN	3 to 8 VPCs (3)	ON/OFF (OR, NICU: OFF, ICU: ON)
	16 to 300 beats/min (OR, ICU: 100 NICU: 140)*[1]	ON/OFF (OR: OFF, ICU, NICU: ON)
V BRADY*[1]	15 to 299 beats/min (OR, ICU: 50 NICU: 60)	ON/OFF (OR, NICU: OFF, ICU: ON)
SV TACHY*[1]	3 to 9 VPCs (6)	ON/OFF (OFF)
	16 to 300 beats/min (OR, ICU: 170 NICU: 210)	ON/OFF (OFF)
PAUSE*[1]	1.0 to 3.0 s (OR, ICU: 3.0 NICU: 1.5)	ON/OFF (ON)
COUPLET	—	ON/OFF (OFF)
EARLY VPC	—	ON/OFF (OFF)
MULTIFORM*[1]	—	ON/OFF (OFF)
V RHYTHM*[1]	—	ON/OFF (OR, NICU: OFF, ICU: ON)
BIGEMINY	—	ON/OFF (OFF)
TRIGEMINY*[1]	—	ON/OFF (OFF)
IRREGULAR RR*[1]	—	ON/OFF (OFF)
PROLONGED RR*[1]	—	ON/OFF (OFF)
NO PACER PULSE*[1]*[2]	—	ON/OFF (OFF)
PACER NON-CAPTURE*[1]*[2]	40 to 480 ms (400)	ON/OFF (OFF)

*[1] These arrhythmias become available when “EXTENDED” is selected for <ARRHYTHMIA TYPE> on the SYSTEM SETUP screen. Refer to Section 3 of the Administrator’s Guide. The arrhythmia type setting is not available for the BSM-6000A series. For BSM-6000A series, arrhythmia type is STANDARD only.

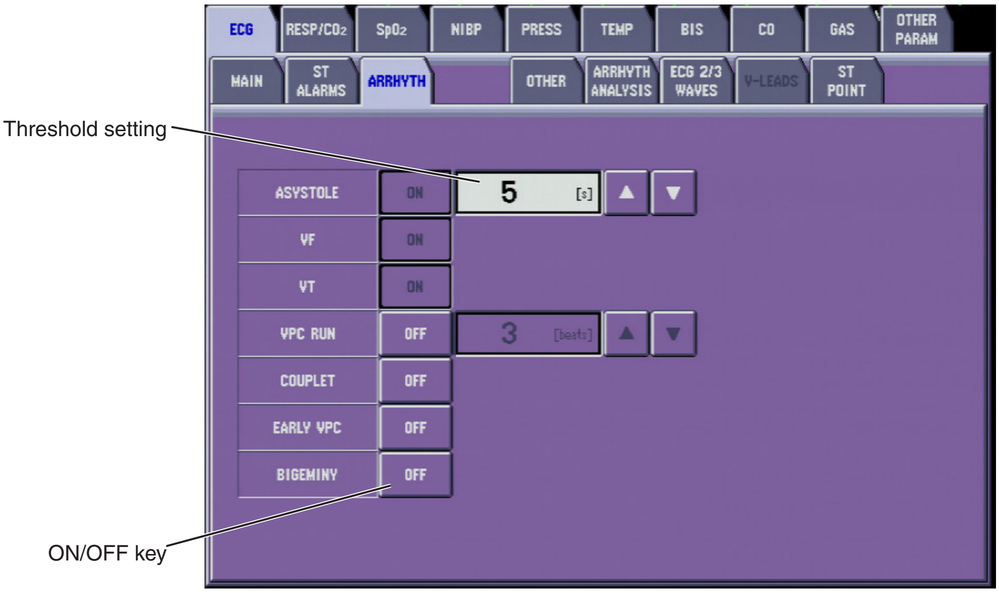
*[2] Available only when pacing detection is set to ON.

You can also set arrhythmia alarm limits on the ARRHYTH ALARMS window (See Operator’s Manual or Section 5 of the User’s Guide Part I).

NOTE

When “EXTENDED” is selected for arrhythmia type and the bedside monitor is connected to a central monitor network that has old software so that “EXTENDED” arrhythmias cannot be monitored, the “COMMUNICATION LOSS” message appears for the bedside monitor and the bedside monitor cannot be monitored on the central monitor.

1. Display the ARRHYTH page of the ECG window.
   Press [Menu] key → ECG key → ARRHYTH tab.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
▲
▼
Threshold setting
ON/OFF key

ASYSTOLE	ON	5 [s]
VF	ON	
VT	ON	
VPC RUN	OFF	3 [beats]
COUPLET	OFF	
EARLY VPC	OFF	
BIGEMINY	OFF	

2. To turn off an arrhythmia alarm
   Touch the ON key to turn it to OFF.

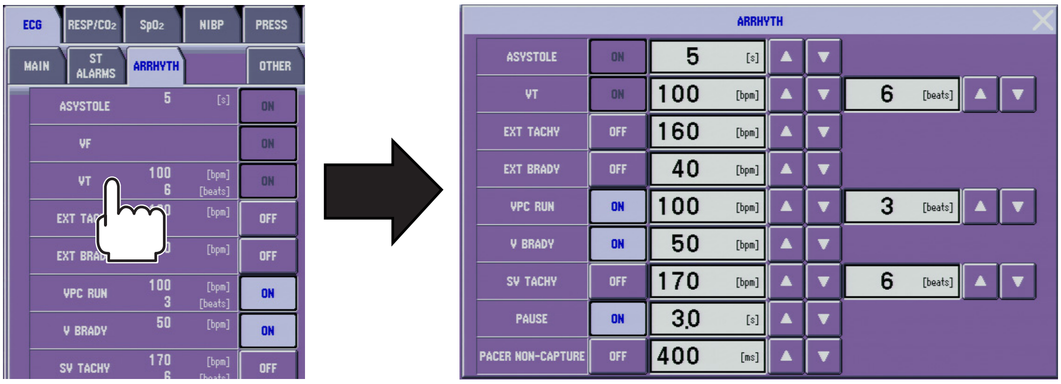
   To turn on an arrhythmia alarm
   Touch the OFF key to turn it to ON.

   To set the threshold
   Use the ▲ or ▼ key to adjust the setting.

NOTE

For BSM-6000A series bedside monitors, items can be turned on or off but thresholds are fixed and cannot be changed. The thresholds are set by the administrator on the MASTER window of the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

When EXTENDED is selected for the arrhythmia type in the SYSTEM SETUP window, touch the threshold to display the ARRHYTH window and adjust the setting.


ECG
RESP/CO2
SpO2
NIBP
PRESS
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH
▲
▼

ASYSTOLE	5 [s]	ON
VF		ON
VT	100 [bpm] 6 [beats]	ON
EXT TA	[bpm]	OFF
EXT BRA	[bpm]	OFF
VPC RUN	100 [bpm] 3 [beats]	ON
V BRADY	50 [bpm]	ON
SV TACHY	170 [bpm]	OFF

ASYSTOLE	ON	5 [s]	
VT	ON	100 [bpm]	6 [beats]
EXT TACHY	OFF	160 [bpm]	
EXT BRADY	OFF	40 [bpm]	
VPC RUN	ON	100 [bpm]	3 [beats]
V BRADY	ON	50 [bpm]	
SV TACHY	OFF	170 [bpm]	6 [beats]
PAUSE	ON	3.0 [s]	
PACER NON-CAPTURE	OFF	400 [ms]	

3. Press the [Home] key to return to the home screen.

Changing the ST Alarm Limits

> **CAUTION**
>
> When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

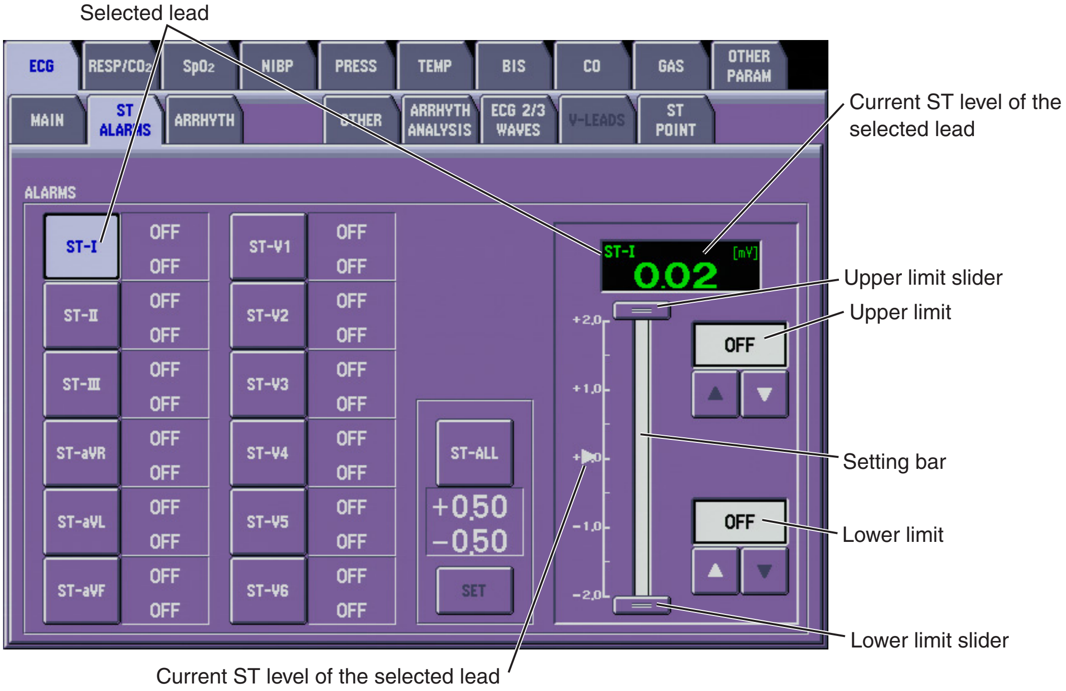
You can set the upper and lower ST alarm limits for each lead individually or altogether on the ECG window. You can set all alarms, including the upper and lower ST of all leads alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

Setting Range

Upper limit: –1.99 to +2.00 mV in 0.01 mV steps (–19.9 to +20.0 mm in 0.1 mm steps), OFF (default setting: OFF)

Lower limit: OFF, –2.00 to +1.99 mV in 0.01 mV steps (–20.0 to +19.9 mm in 0.1 mm steps) (default setting: OFF)

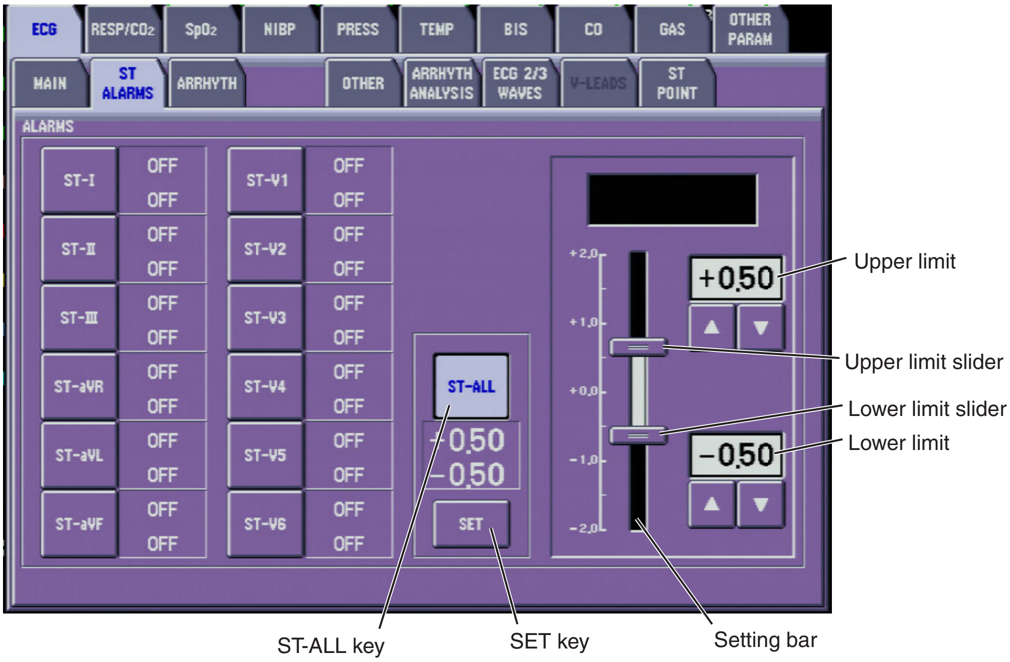
1. Display the ST ALARMS page of the ECG window.
   Press [Menu] key → ECG key → ST ALARMS tab.


Selected lead
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
ALARMS
ST-I
ST-II
ST-III
ST-aVR
ST-aVL
ST-aVF
ST-V1
ST-V2
ST-V3
ST-V4
ST-V5
ST-V6
OFF
ST-ALL
+0.50
−0.50
SET
ST-I [mV]
0.02
+2.0
+1.0
0
−1.0
−2.0
Current ST level of the selected lead
Upper limit slider
Upper limit
Setting bar
Lower limit
Lower limit slider
Current ST level of the selected lead

2. To set the upper and lower alarm for a lead
   i) Select the lead.
   ii) Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.
   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

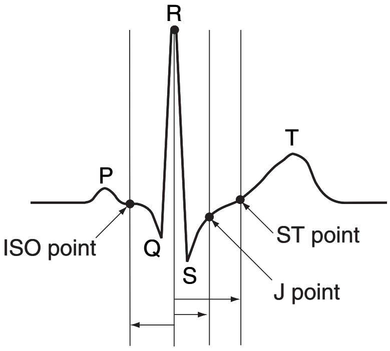
   To set alarms altogether for all leads according to the current ST value
   i) Touch the ST-ALL key.
   ii) Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

iii) Touch the SET key to set the upper and lower limits according to the current value of the ST value.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
ALARMS
ST-I
ST-II
ST-III
ST-aVR
ST-aVL
ST-aVF
ST-V1
ST-V2
ST-V3
ST-V4
ST-V5
ST-V6
OFF
ST-ALL
+0.50
-0.50
SET
+2.0
+1.0
+0.0
-1.0
-2.0
+0.50
-0.50
Upper limit
Upper limit slider
Lower limit slider
Lower limit
ST-ALL key
SET key
Setting bar

3. Press the [Home] key to return to the home screen.

Changing the ST Level Measurement Condition


R
T
P
ISO point
Q
S
ST point
J point

In the ST level measurement, the ISO point determines the baseline and the ST point and J point determine the ST level from the baseline. You can change the ISO point, J point and ST point for ST level measurement.

NOTE

Although the ST algorithm has been tested for accuracy of the ST analysis result, the significance of the ST level changes need to be determined only by a physician.

Setting Range

ISO point: (R –) 0 to 248 ms in 4 ms steps
J point: (R +) 0 to 340 ms in 4 ms steps
ST point: (R +) R +: 0 to * ms in 4 ms steps
* When J point is set to R +: 340 ms, ST point is J + 0 ms.

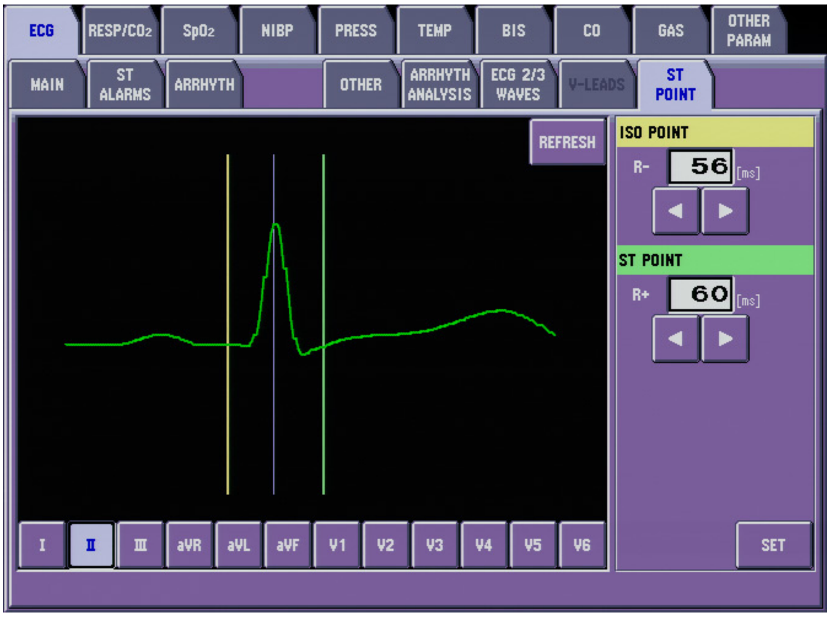
Default Setting

When <QRS DETECTION TYPE> is set to ADULT:
ISO point: R – 80
J point: R + 48
ST point: R + 60
When <QRS DETECTION TYPE> is set to CHILD or NEONATE:
ISO point: R – 56
ST point: R + 60

When QRS DETECTION TYPE is set to CHILD or NEONATE

1. Display the ST POINT page of the ECG window.
   Press [Menu] key → ECG key → ST POINT tab.

2. Select the lead(s) by touching the lead key to be displayed on the ST POINT page. The QRS wave(s) of the selected lead(s) appears on the window.

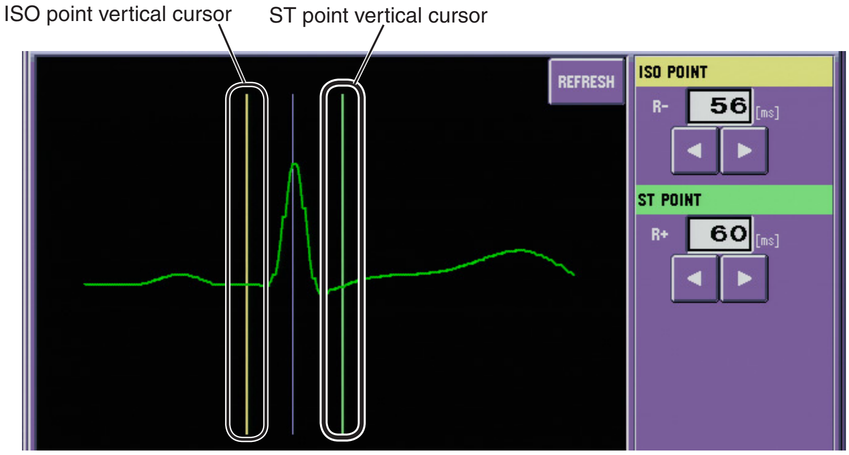

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
REFRESH
ISO POINT
R-
56
[ms]
ST POINT
R+
60
[ms]
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
SET

If the QRS wave does not appear on the window, close the window then open it again.

NOTE

R point vertical cursor is fixed.

3. To change the ISO point and ST point


ISO point vertical cursor
ST point vertical cursor
REFRESH
ISO POINT
R-
56
[ms]
ST POINT
R+
60
[ms]

   i) Touch the ISO point vertical cursor and ST point vertical cursor to move the vertical cursor left to right.
   ii) Touch the ◀ or ▶ key to move the vertical cursor left or right to adjust the setting. The cursor moves in 4 ms steps.

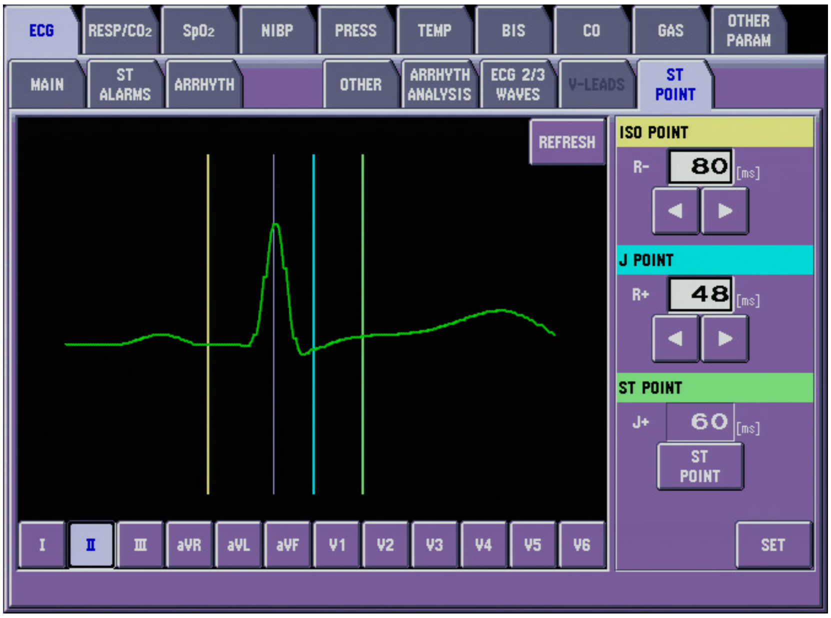
4. To register the ST level measurement condition settings, touch the SET key. The ST level is measured with the new measurement condition settings.
   To refresh the QRS waves on the ST POINT window, touch the REFRESH key.

5. Press the [Home] key to return to the home screen.

When QRS DETECTION TYPE is set to ADULT

1. Display the ST POINT page of the ECG window.
   Press [Menu] key → ECG key → ST POINT tab.

2. Select the lead(s) by touching the lead key to be displayed on the ST POINT page. The QRS wave(s) of the selected lead(s) appears on the window.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
REFRESH
ISO POINT
R-
80
[ms]
◀ ▶
J POINT
R+
48
[ms]
◀ ▶
ST POINT
J+
60
[ms]
ST POINT
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
SET

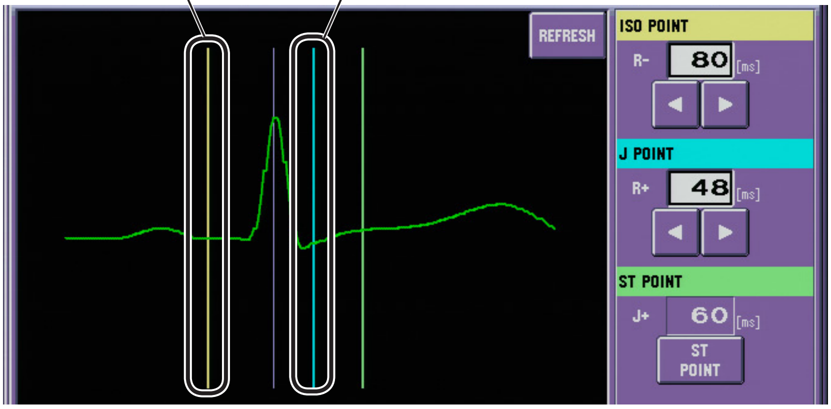
If the QRS wave does not appear on the window, close the window then open it again.

NOTE

- R point vertical cursor is fixed.
- When moves the J point vertical cursor, ST point vertical cursor also moves.

3. To change ISO and J points
   i) Touch the ISO point vertical cursor and J point vertical cursor to move the vertical cursor left to right.
   ii) Touch the ◀ or ▶ key to move the vertical cursor left or right to adjust the setting. The cursor moves in 4 ms steps.

ISO point vertical cursor J point vertical cursor


REFRESH
ISO POINT
R-
80
[ms]
◀ ▶
J POINT
R+
48
[ms]
◀ ▶
ST POINT
J+
60
[ms]
ST POINT

To change the ST point

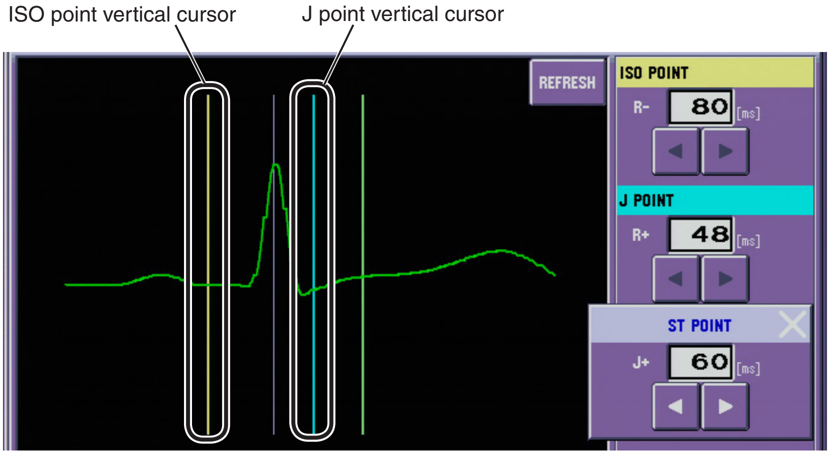
i) Touch the ST POINT key to open the ST POINT dialog box.

ii) Touch the ST point vertical cursor to move the vertical cursor.

iii) Touch the ◀ or ▶ key to move the vertical cursor left or right. The cursor moves in 4 ms steps.

iv) Touch the ☒ key to close the dialog box.

4. To register the ST level measurement condition settings, touch the SET key. The ST level is measured with the new measurement condition settings.


ISO point vertical cursor
J point vertical cursor
REFRESH
ISO POINT
J POINT
ST POINT
◀ ▶

ISO POINT R- 80 [ms]

J POINT R+ 48 [ms]

ST POINT J+ 60 [ms]

To refresh the QRS waves on the ST POINT window, touch the REFRESH key.

5. Press the [Home] key to return to the home screen.

Changing Pacing Settings

Turning Pacing Spike Detection On or Off

When the patient has an implanted cardiac pacemaker, the pacing pulse may be counted as QRS and the heart rate may be miscounted. The pacing pulse is a very small wave which cannot be displayed on the monitor. When pacing spike detection is set to ON, the pacemaker spikes are rejected which allows correct heart rate counting. When pacing mark is set to ON, the pacing mark is displayed on the ECG. Refer to the "Displaying Pacing Mark" section.

The pacing spike detection is automatically turned on when <PACE MAKER> on the ADMIT window is set to YES.

When pacing spike detection is set to OFF, the non-paced mark ☒ appears in the upper right of the screen.

WARNING

Turn the pacing pulse detection* to ON when monitoring a pacemaker patient. Otherwise the pacemaker pulse is not rejected. However, even when the pacing pulse detection is set to ON, the pacemaker pulse might not be rejected. When the pacemaker pulse is not rejected, the pacemaker pulse is detected as QRS and false heart rate may be indicated or critical arrhythmia such as asystole may be overlooked. Keep pacemaker patients under close observation.

* For the pacemaker pulse rejection capability of BSM-6000 series bedside monitor, refer to the "Specifications - ECG" in operator's manual.

WARNING

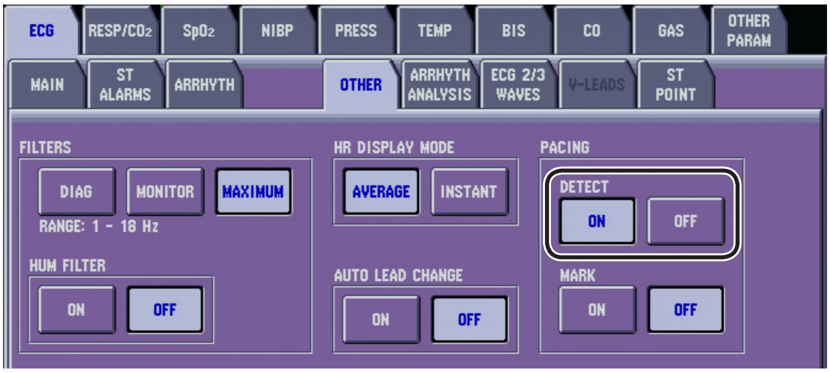
Even when the pacing pulse detection is set to ON, the pacemaker pulse can be overlooked or detected as QRS. You cannot confirm the pacemaker operation only from the detected pacemaker pulse.

NOTE

When you monitor a premature baby or infant and the monitor miscounts the narrow width QRS, set this to OFF.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Touch the ON or OFF key under <DETECT> in the <PACING> box to select on or off.

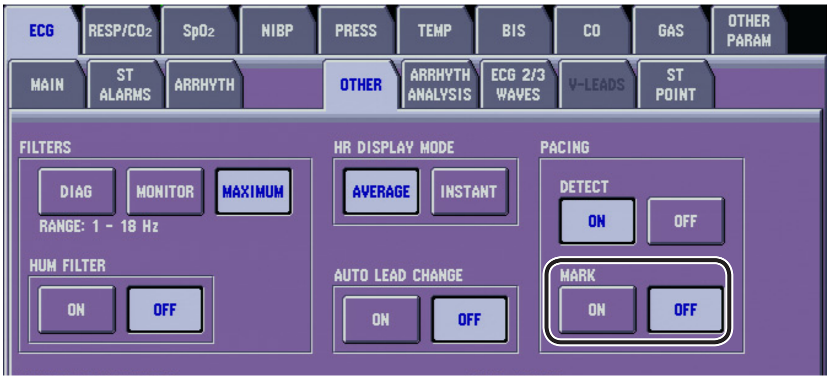

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF

Displaying Pacing Mark

When the <PACING DETECT> is set to ON, the pacing mark can be displayed on the ECG waveform.

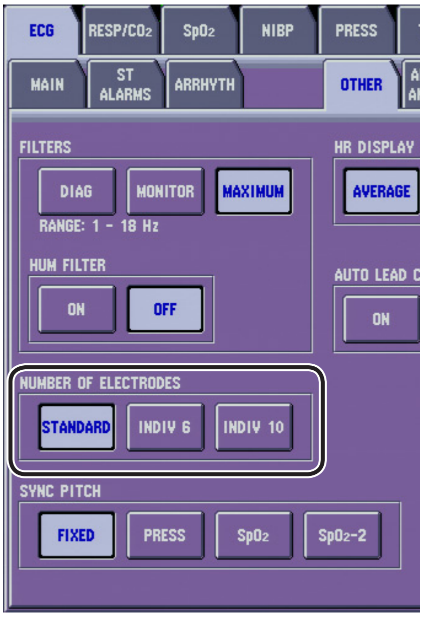
1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Touch the ON or OFF key under <MARK> in the <PACING> box to select on or off. When set to ON, the pacing mark is displayed on the ECG waveform.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF

3. Press the [Home] key to return to the home screen.

Changing the Number of Electrodes


ECG
RESP/CO2
SpO2
NIBP
PRESS
MAIN
ST ALARMS
ARRHYTH
OTHER
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY
AVERAGE
AUTO LEAD
ON
NUMBER OF ELECTRODES
STANDARD
INDIV 6
INDIV 10
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2

Select the type and number of electrodes.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Select the type and number of electrodes in the <NUMBER OF ELECTRODES> box.
   STANDARD: Any electrodes other than DIN type. The number of electrodes (3, 6 or 10) is automatically recognized by the monitor.
   INDIV 6: Monitoring with 3 or 6 DIN type electrodes.
   INDIV 10: Monitoring with 10 DIN type electrodes. The RF/RL electrode must be attached.

3. Press the [Home] key to return to the home screen.

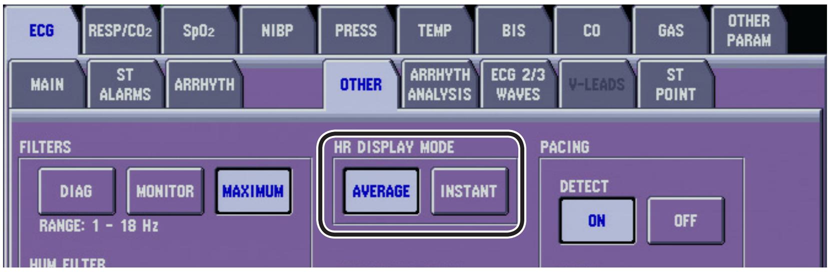
Selecting Mode for Updating the Heart Rate

There are two calculation modes, “AVERAGE” and “INSTANT”.

AVERAGE:	The heart rate is calculated by a moving average. The monitor detects 12 consecutive beats including VPC, averages the R-R intervals of the latest 12 beats and uses this average to calculate the current heart rate. When a new beat is detected, the heart rate is recalculated using the latest 12 beats. The heart rate display is updated every 3 seconds.
INSTANT:	The heart rate is calculated every beat. The heart rate display is updated every 3 seconds.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Select “AVERAGE” or “INSTANT” in the <HR DISPLAY MODE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
HR DISPLAY MODE
AVERAGE
INSTANT
PACING
DETECT
ON
OFF

3. Press the [Home] key to return to the home screen.

Selecting the Filter Type

There are following types for ECG filter.

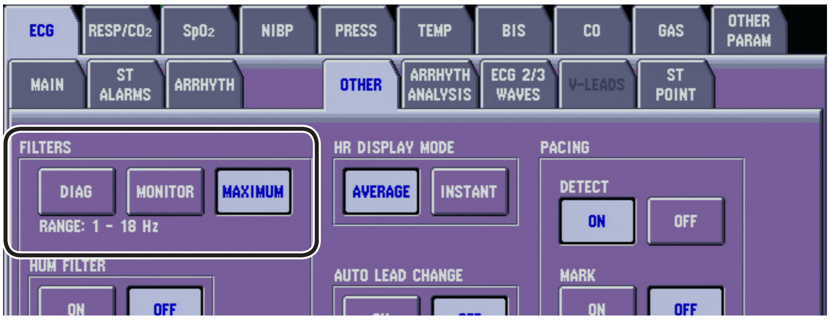
DIAG:	No filter. This mode is best for viewing the details of the waveform. It is similar to the real ECG. (0.05 to 150 Hz)
MONITOR:	Low-cut and high-cut filter. (0.3 to 40 Hz)
MAXIMUM:	Baseline drift-free, hum (AC) and high-cut filter. Appropriate when there is noise from AC or ESU. (1 to 18 Hz)

NOTE

When performing defibrillation, set the <FILTERS> to MONITOR or MAXIMUM. The waveform recovery may become slow due to electrode polarization when DIAG is set.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Select filter type from the <FILTERS> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
PACING
DETECT
ON
OFF
MARK
ON
OFF

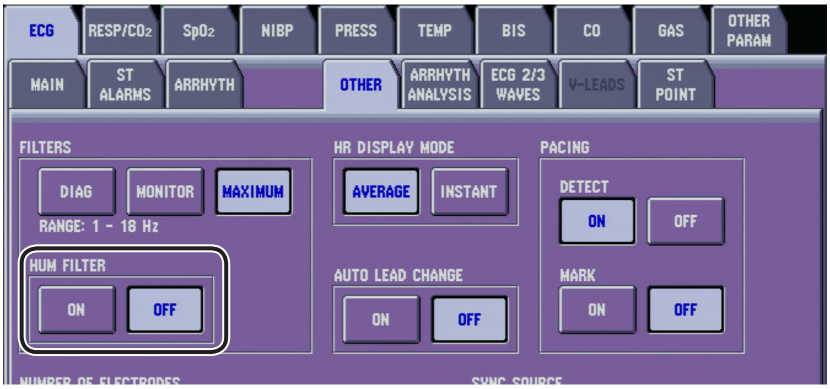
3. Press the [Home] key to return to the home screen.

Turning the Hum Filter On or Off

The hum filter type is set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Touch the ON or OFF key under <HUM FILTER> in the <FILTERS> box select on or off.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF
NUMBER OF ELECTRODES
SYNC SOURCE

3. Press the [Home] key to return to the home screen.

Changing the Sync Sound Source

You can select ECG, SpO_2 pulse (SpO_2) or arterial blood pressure pulse (PRESS) as the sync sound source. When the arterial blood pressure pulse is selected, the blood pressure of the highest priority label is used. The sync source can also be changed on the SpO_2 and PRESS windows.

When pulse wave and pressure waveform are irregular because of an IABP, select ECG.

NOTE

- When heart rate is unstable because of an ESU, select SpO_2 or PRESS.
- When the connection cord of SpO_2 or IBP of the arterial blood pressure is disconnected from the monitor and an alarm occurs when the sync

source is set to SpO_2 or PRESS, the sync source changes to ECG when the alarm is silenced by pressing the [Silence Alarms] key. The sync source returns to SpO_2 or PRESS when the SpO_2 or IBP is monitored again. When using PRESS as the sync source, adjust zero balance.

- When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO_2 or PRESS, the sync source does not change to ECG when the alarm is silenced, and "- - -" is displayed for PR.
- The SpO_2-2 cannot be set to the sync sound source.

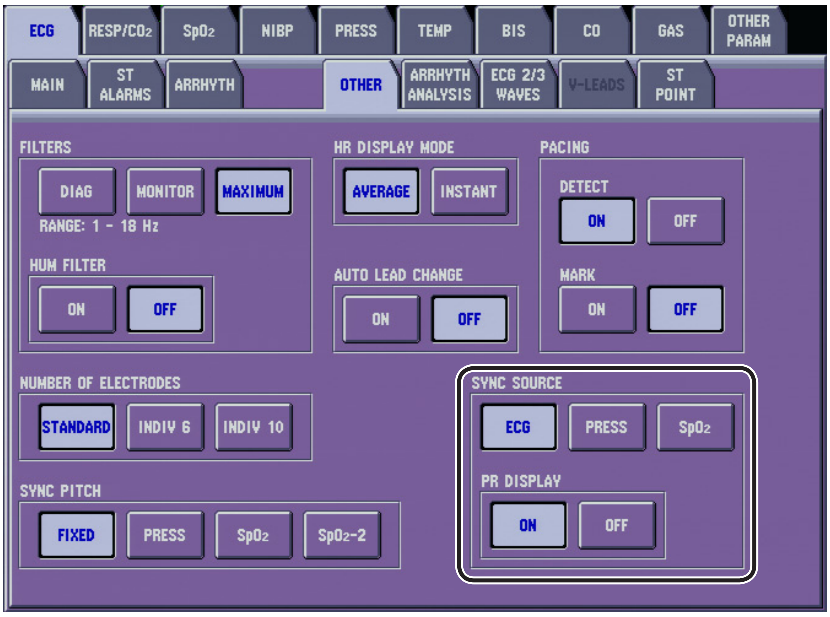
When the sync source is set to ECG and ECG is not measured, there is no sync sound.

When SpO_2 or PRESS is selected, the pulse rate is displayed to the left of the heart rate on the screen and the sync mark synchronizes with the pulse.

1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Select the sync source in the <SYNC SOURCE> box.
   ECG: QRS
   PRESS: Pulse wave of the highest priority arterial blood pressure
   SpO_2: SpO_2 pulse

   To display the pulse rate to the left of the heart rate on the home screen, select ON for <PR DISPLAY>. This setting is only available when <SYNC SOURCE> is set to ECG.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF
NUMBER OF ELECTRODES
STANDARD
INDIV 6
INDIV 10
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF

3. Press the [Home] key to return to the home screen.

Selecting Sync Sound Pitch

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set on the SYSTEM SETUP window (see Section 3 of the Administrator's Guide). When you select variable pitch, the pitch of the sync sound changes according to SpO_2 value or systolic BP value of the arterial blood pressure so that you can recognize the change on the patient from the pitch of the sync sound without looking at the monitor. The sync pitch can also be changed on the SpO_2 and PRESS windows.

When using AY-661P, AY-663P, AY-671P or AY-673P input unit, the sync sound pitch can be set to change according to the SpO_2 value of the second SpO_2 (SpO_2-2) when monitoring dual SpO_2. (AY-661P or AY-663P input units are not available for BSM-6000A series.)

When the sync sound source is set to SpO_2 and the SpO_2 value is below 81%SpO_2, the low pitch is automatically selected.

When the sync sound source is set to SpO_2 and the "CHECK PROBE" or "DETECTING PULSE" message is displayed on the screen, the sync sound stops.

When the sync sound source is set to ECG or PRESS, the sync pitch is set to SpO_2 and the SpO_2 cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2, the sync pitch is set to PRESS and the IBP cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2 and the IBP connection cord is disconnected, the low pitch is automatically selected. After connecting the IBP connection cord, adjust zero balance.

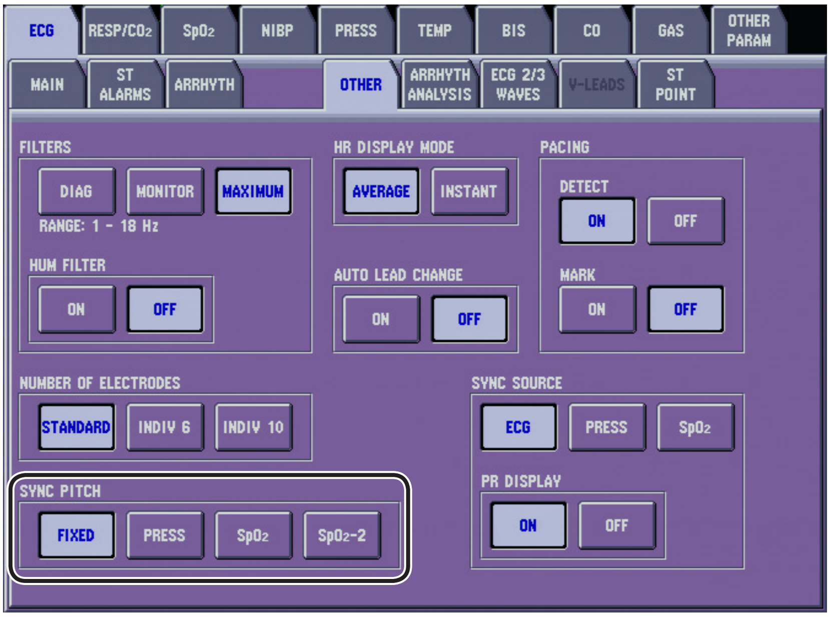
1. Display the OTHER page of the ECG window.
   Press [Menu] key → ECG key → OTHER tab.

2. Select the sync sound pitch from the <SYNC PITCH> box.

FIXED:	The pitch is fixed to the pitch selected on the SYSTEM SETUP window.
PRESS:	The pitch is high when the BP value is above 120 mmHg. The pitch is low when the BP value is below 20 mmHg. The pitch changes from high to low in 20 steps for each 5 mmHg change between 120 and 20 mmHg BP value. The BP value of the highest priority arterial blood pressure is used.

SpO_2 and SpO_2-2: The pitch changes in 20 steps from high to low for each 1%SpO_2 change in SpO_2 value between 100%SpO_2 and 81%SpO_2.

When the SpO_2 is selected, the pitch changes according to the SpO_2 value acquired from the SpO_2 socket. When the SpO_2-2 is selected, the pitch changes according to the second SpO_2 (SpO_2-2) value acquired from the MULTI socket. (SpO_2-2 is only available when using an AY-661P, AY-663P, AY-671P or AY-673P input unit.)


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
ST ALARMS
ARRHYTH
OTHER
ARRHYTH ANALYSIS
ECG 2/3 WAVES
V-LEADS
ST POINT
FILTERS
DIAG
MONITOR
MAXIMUM
RANGE: 1 - 18 Hz
HUM FILTER
ON
OFF
HR DISPLAY MODE
AVERAGE
INSTANT
AUTO LEAD CHANGE
ON
OFF
PACING
DETECT
ON
OFF
MARK
ON
OFF
NUMBER OF ELECTRODES
STANDARD
INDIV 6
INDIV 10
SYNC SOURCE
ECG
PRESS
SpO2
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PR DISPLAY
ON
OFF

3. Press the [Home] key to return to the home screen.

Use with an Electrosurgical Unit

For use with an electrosurgical unit (ESU), this monitor has a circuit to protect the patient from skin burn and to reduce ESU interference on the ECG waveform. However, the effectiveness of this circuit depends on electrode position and monitor setup. With an ESU, pay attention to the following points.

WARNING

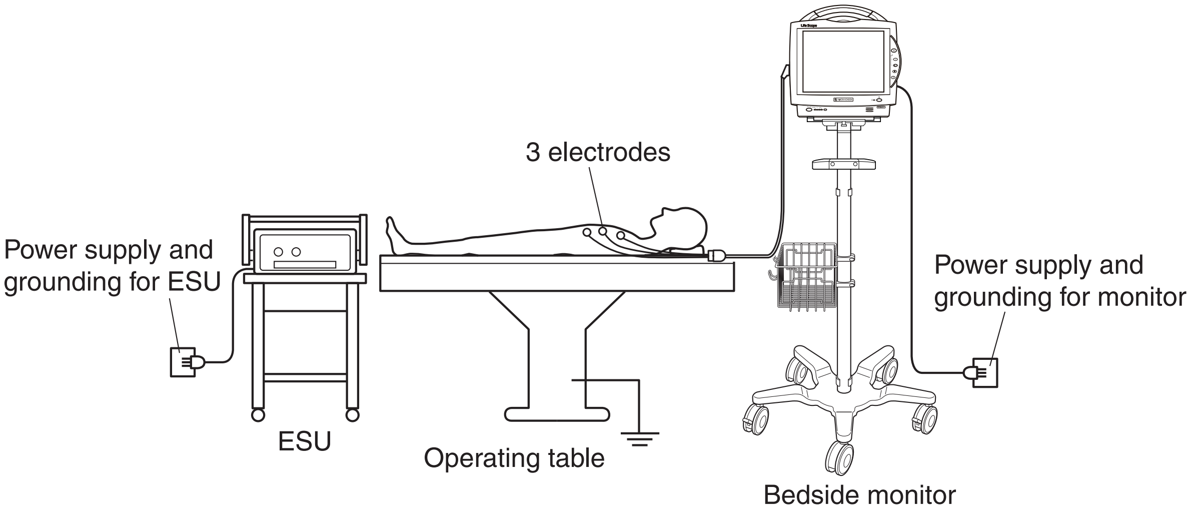
When the monitor is used with an electrosurgical unit (ESU), firmly attach the entire area of the ESU return plate. Otherwise, the current from the ESU flows into the electrodes of the monitor, causing electrical burn where the electrodes are attached. For details, refer to the ESU manual.

CAUTION

When using the monitor with an ESU, locate the monitor and ESU appropriately and ground instruments properly. Otherwise noise from the ESU may interfere with the ECG and the heart rate and arrhythmia analysis may be incorrect.

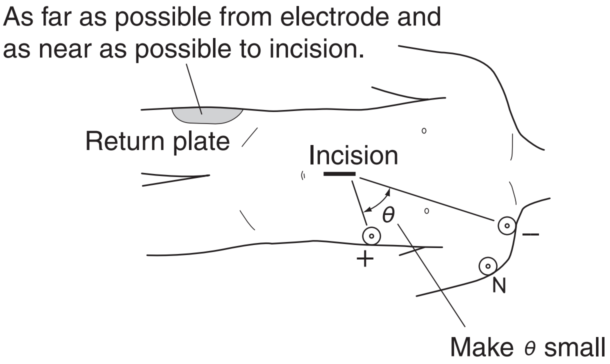
- Arrangement
  Install the monitor as far from the ESU as possible. If possible, locate them on opposite sides of the operating table.

- Power supply
  Noise from the ESU may interfere with the ECG signal through the AC power line. Supply power to the monitor and ESU from different outlets located as far from each other as possible. Do the equipotential grounding properly.


3 electrodes
Power supply and grounding for ESU
Power supply and grounding for monitor
ESU
Operating table
Bedside monitor

- Measure with 3-electrode lead
  Use the minimum number of electrodes. Use new electrodes.

- Minimize noise
  1. Select an ECG lead where the active ECG electrodes are located as far from the incision as possible.
  2. Position the + and – electrodes as close as possible.
  3. Select the leads where the angle (θ) between the active electrodes and the incision is as small as possible.
  4. Set the electrosurgical return plate as close to the incision as possible.


As far as possible from electrode and as near as possible to incision.
Return plate
Incision
θ
+
–
N
Make θ small

- Set the following items on the OTHER page of the ECG window.

FILTERS: MAXIMUM
SYNC SOURCE: SpO_2 or PRESS

- Monitor respiration by thermistor method or monitor CO_2

Noise is superimposed on the waveform and the respiration rate cannot be monitored accurately in the impedance method. When monitoring respiration, turn respiration monitoring off or monitor the respiration by thermistor method or monitor CO_2.

Section 2 Respiration Monitoring

General 2.2
  Measurement Method 2.2
    Impedance Method 2.2
    Thermistor Method 2.3
Preparing for Respiration Monitoring in Impedance Method 2.3
  Preparation Flowchart 2.3
  Electrode Position and Waveform Examples 2.4
    Electrode Position 2.5
    Amplitude 2.5
  Connecting Cables and Attaching Disposable Electrodes 2.6
Preparing for Respiration Monitoring in Thermistor Method 2.6
  Preparation Flowchart 2.6
  Respiration Pickups 2.6
  Connecting the Cable to the Unit 2.7
  Attaching the Respiration Pickup 2.7
    When Using Respiration Pickup for Nose 2.7
    When Using Respiration Pickup for Airway 2.7
Monitoring Respiration 2.8
  Respiration Information on the Home Screen 2.8
Changing Respiration Settings 2.10
  Changing the Monitoring Lead in Impedance Method 2.10
  Changing the Respiration Sensitivity 2.11
  Turning Respiration Measurement On or Off in Impedance Method 2.12
  Changing the Respiration Rate and Apnea Alarm Limits 2.13
  Changing the Respiration Waveform Sweep Speed 2.14

General

On this monitor, respiration can be measured by two methods: impedance method and thermistor method. When respiration is measured by both the impedance method and thermistor method, the values measured by the thermistor method is used.

Measurement Method

Impedance Method

In the impedance method, respiration is measured and monitored by attaching the ECG electrodes to the patient and connecting them to the ECG/RESP socket on the input unit. This method measures changes in impedance between the R and F (RA and LL) or R and L (RA and LA) ECG electrodes.

WARNING

Interaction Between Minute Ventilation Rate-Adaptive Pacemakers and Cardiac Monitoring and Diagnostic Equipment*

The bioelectric impedance measurement sensor of a minute ventilation rate-adaptive implantable pacemaker may be affected by cardiac monitoring and diagnostic equipment which is connected to the same patient. If this occurs, the pacemaker may pace at its maximum rate and give incorrect data to the monitor or diagnostic equipment. In this case, set the <IMP RESP MEASURE> on the RESP/CO_2 window to OFF on the bedside monitor. For a patient that requires the respiration monitoring, measure the respiration by thermistor method.

* Minute ventilation is sensed in rate-adaptive pacemakers by a technology known as bioelectric impedance measurement (BIM). Many medical devices in addition to pacemakers use this technology. When one of these devices is used on a patient with an active, minute ventilation rate-adaptive pacemaker, the pacemaker may erroneously interpret the mixture of BIM signals created in the patient, resulting in an elevated pacing rate.
For more information, see the FDA web site.
http://www.fda.gov/cdrh/safety.html

Thermistor Method

In the thermistor method, respiration is measured and monitored by attaching the respiration pickup to the patient or connecting it to the respiration circuit, and connecting the respiration pickup to the MULTI socket on the unit.

This method measures and compares temperature changes caused by respiration and inspiration using the respiration pickup.

Use this method when using an ESU or if measurement by the impedance method is unavailable.

NOTE

The MULTI socket on the AY-660P input unit cannot be used for monitoring respiration in thermistor method.

Preparing for Respiration Monitoring in Impedance Method

Preparation Flowchart

The procedure is the same as for monitoring ECG.

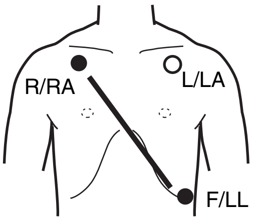
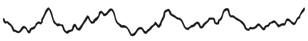
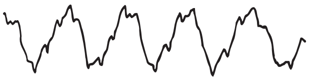
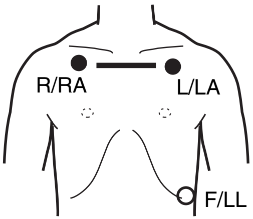
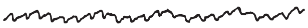
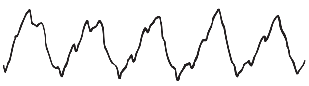
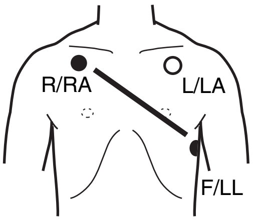
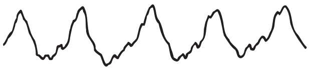
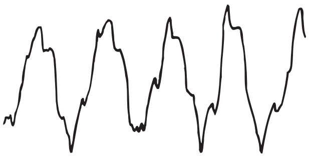
1. Select the electrode lead.
2. Connect the electrode lead to the ECG connection cord and connect the ECG connection cord to the ECG/RESP socket on the input unit.
3. Attach the disposable electrodes to the patient and attach the electrode lead to the electrodes. Attach R and F (RA and LL) or R and L (RA and LA) with the lungs between the electrodes.
4. Monitoring starts. Set necessary settings.

Electrode Position and Waveform Examples

Respiration can be measured by the impedance method when the R (RA) and F (LL) or R (RA) and L (LA) electrodes are placed so that the lungs are between the electrodes.

The optimum electrode positions for ECG monitoring of a patient are not always optimum for respiration monitoring of the patient. Select the optimum positions for both ECG and respiration measurements or measure respiration by the thermistor method.

The amplitude of the respiration waveform differs according to the electrode position. The following shows different examples of respiration waveforms according to the electrode position when monitoring with the impedance method.

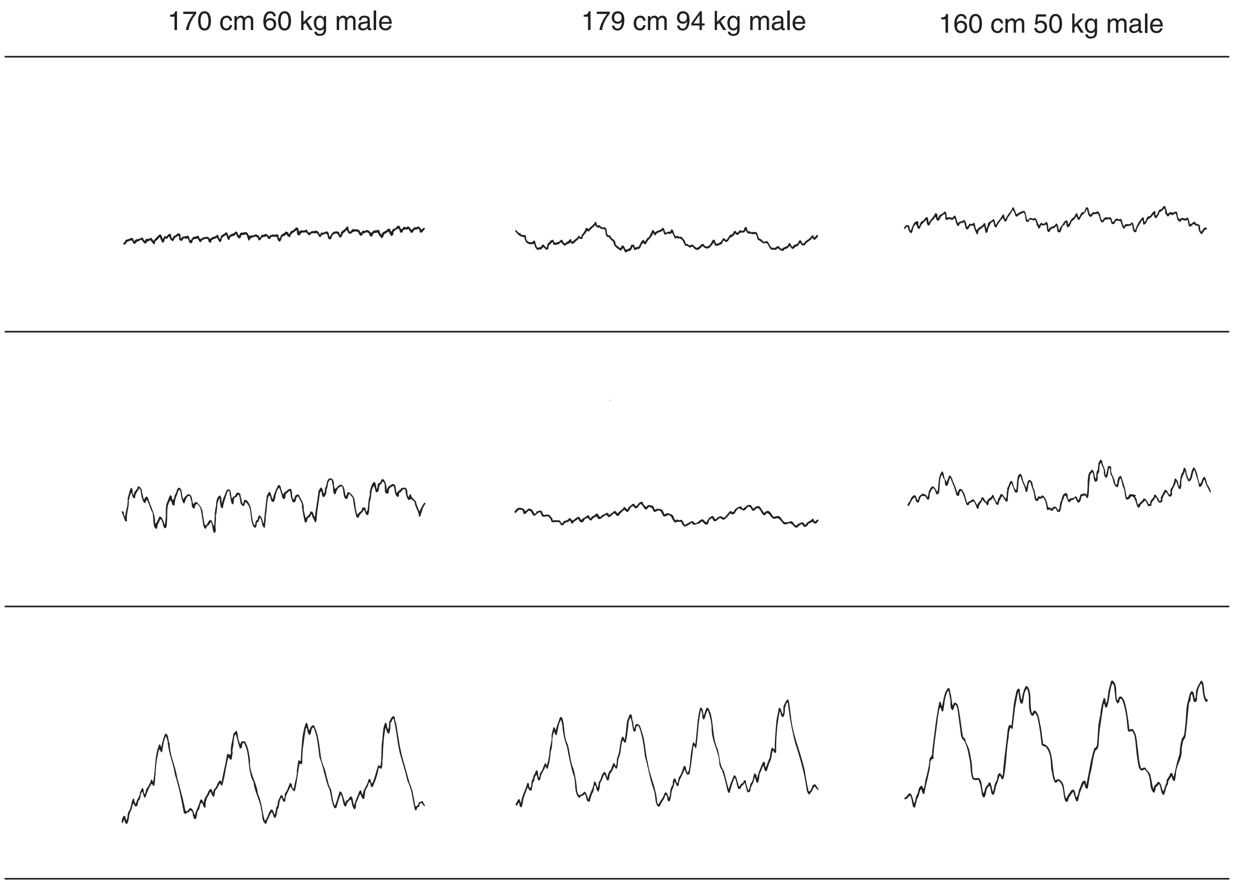
	Electrode lead and position	162 cm 47 kg female	153 cm 45 kg female
1	 Standard R-F/RA-LL		
2	 R-L/RA-LA		
3	 R-F/RA-LL with higher F/LL position		

Electrode Position

	R or RA	F or LL	L or LA
1	Right infraclavicular fossa	Lowest rib on the left anterior axillary line	—
2	Right infraclavicular fossa	—	Left infraclavicular fossa
3	Right infraclavicular fossa	Fifth intercostal space on the left midaxillary line	—

Amplitude

1	Respiration measurement is influenced by movement of the chest and abdomen. The amplitude of the waveform changes greatly according to slight change of the F (LL) electrode position. It also differs considerably between different patients.
2	Respiration measurement is influenced by movement of the chest. Detects thoracic respiration. There is a great difference in amplitude between different patients.
3	Respiration amplitude is large, and therefore, detection rate is good. The electrode position is similar to lead II of the ECG. This position is highly recommended.



Connecting Cables and Attaching Disposable Electrodes

Connecting cables and attaching disposable electrodes are the same as for the ECG monitoring. Refer to “Preparing for ECG Monitoring” in Section 1.

Preparing for Respiration Monitoring in Thermistor Method

Preparation Flowchart

1. Select the respiration pickup.
2. Connect the respiration pickup to the MULTI socket on the unit.
3. Attach the respiration pickup to the respiration circuit.
4. Monitoring starts. Set necessary settings.

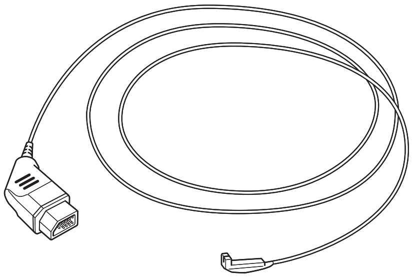
Respiration Pickups

CAUTION

Only use Nihon Kohden specified electrodes, probes, transducers, thermistors and catheters. Otherwise, the maximum performance from the monitor cannot be guaranteed.

Respiration pickup for nose TR-900P*

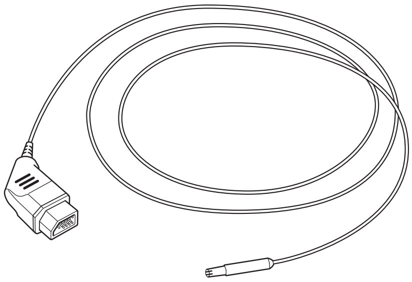
For measuring at nostrils.



* This part has not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

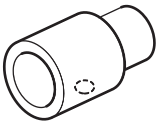
Respiration pickup for airway TR-910P

For measuring with trachea intubation.



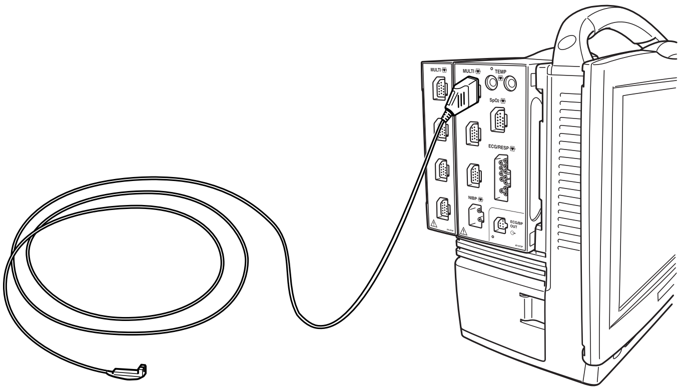
Airway adapter YG-001P

Use with the TR-910P respiration pickup.



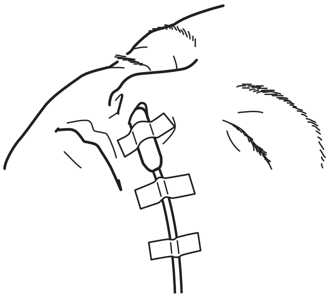
Connecting the Cable to the Unit

Connect the respiration pickup to the MULTI socket on the unit.



When connecting the TR-900P respiration pickup for nose

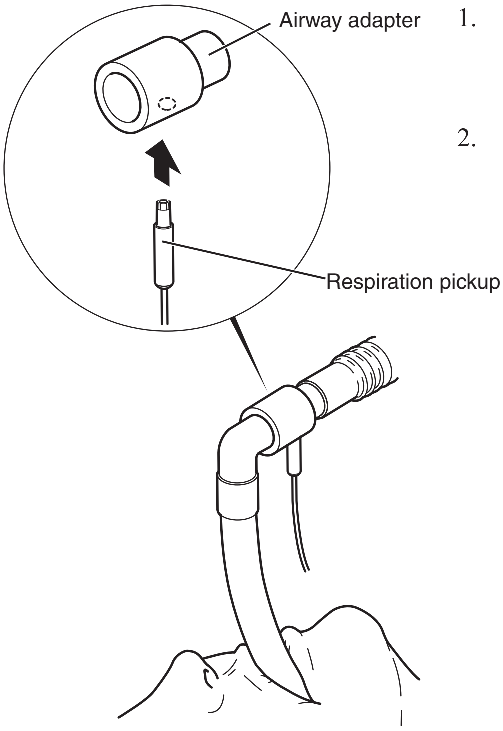
Attaching the Respiration Pickup



When Using Respiration Pickup for Nose

1. Place the tip of the respiration pickup at the front of the nostril.

2. Secure the lead wire and respiration pickup firmly to the cheek with surgical tape.



When Using Respiration Pickup for Airway

1. Firmly insert the tip of the respiration pickup for airway into the small hole on the airway adapter.

2. Connect the airway adapter to the airway tube (between the mouth and Y-shaped tube).

Monitoring Respiration

When preparation is done properly, the respiration waveform appears on the screen.

NOTE

Increase in the temperature of the inspired air during monitoring in thermistor method causes decrease in the temperature difference between inspiration and expiration, and the amplitude of the respiration waveform becomes small. When the inspiration temperature increases higher than the expiration temperature, the phases of expiration and inspiration may be reversed.

In impedance method, the respiration data do not appear on the screen when respiration monitoring in impedance method is set to OFF (the “RESP OFF” message appears). When using an ESU, noise is superimposed on the waveform and the respiration measurement cannot be monitored accurately. When respiration monitoring is necessary, use the thermistor method or monitor CO_2.

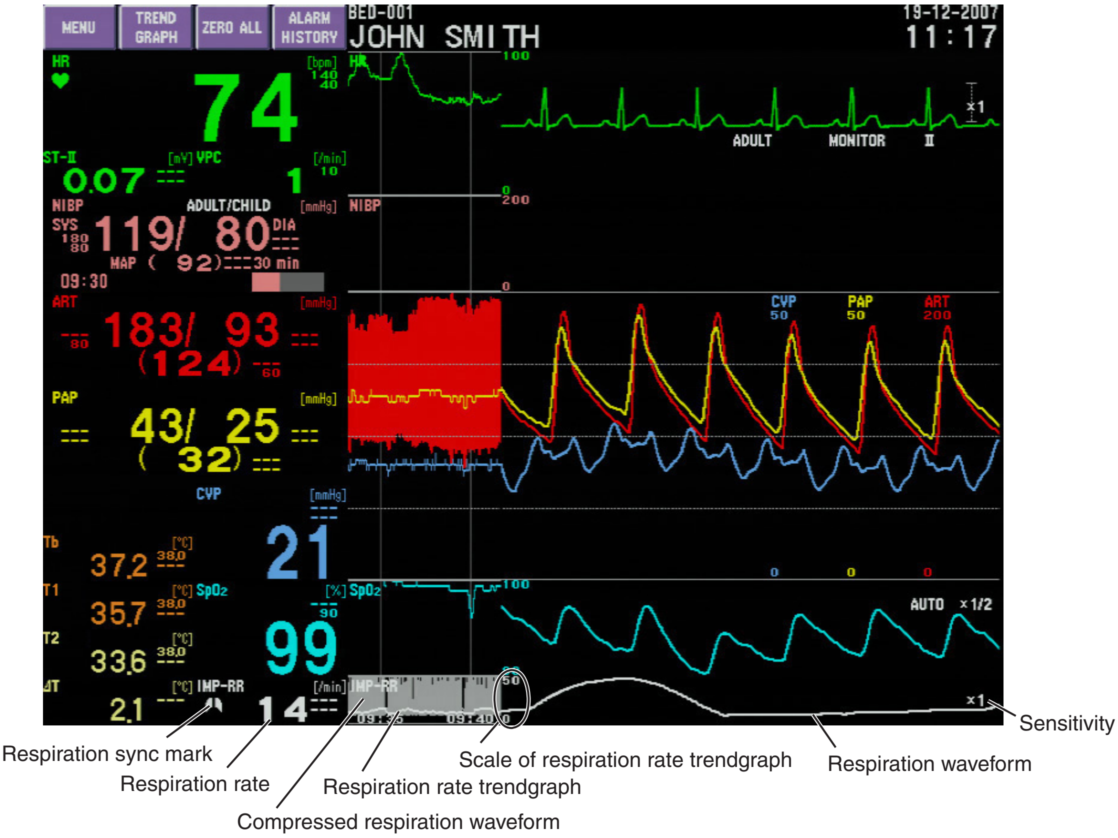
NOTE

The respiration rate can only be detected from one parameter. When CO_2, respiration and anesthetic gas are monitored at the same time, the respiration rate is detected in the following priority.

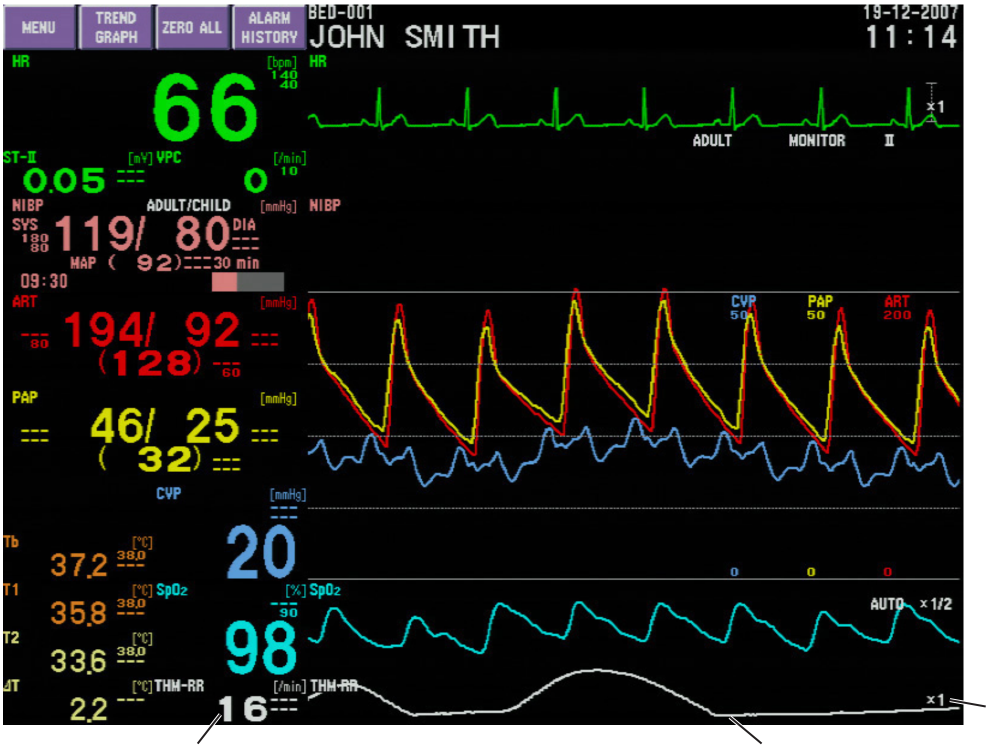
Gas > CO_2 > thermistor respiration > impedance respiration

Respiration Information on the Home Screen

In impedance method


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
19-12-2007
11:17
HR
74
ST-II
0.07
VPC
1
NIBP
ADULT/CHILD
SYS
119/ 80
DIA
MAP (92)
30 min
09:30
ART
183/ 93
(124)
PAP
43/ 25
(32)
CVP
21
Tb
37.2
T1
35.7
T2
33.6
ΔT
2.1
SpO2
99
IMP-RR
14
ADULT
MONITOR
II
×1
CVP 50
PAP 50
ART 200
AUTO ×1/2
09:35
09:40
Sensitivity
Respiration sync mark
Respiration rate
Compressed respiration waveform
Respiration rate trendgraph
Scale of respiration rate trendgraph
Respiration waveform

In thermistor method


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
19-12-2007
11:14
HR [bpm] 140 40
66
ST-II [mV] 0.05
VPC [/min] 10 0
ADULT MONITOR II
NIBP ADULT/CHILD [mmHg]
SYS 180 80 119/ 80 DIA
MAP (92) 30 min
09:30
ART [mmHg] 80 194/ 92 (128) 60
PAP [mmHg] 46/ 25 (32)
CVP [mmHg] 20
CVP 50 PAP 50 ART 200
Tb [°C] 37.2 38.0
T1 [°C] 35.8 38.0
T2 [°C] 33.6 38.0
ΔT [°C] 2.2
SpO2 [%] 90 98
AUTO ×1/2
THM-RR [/min] 16
×1

Respiration rate

Respiration waveform

Sensitivity

Changing Respiration Settings

Change settings on the RESP/CO_2 window. The following settings can be changed for respiration monitoring.

For impedance method

- Turning respiration monitoring on or off
- Changing monitoring lead
- Respiration sensitivity
- Respiration rate and apnea alarm limits
- Respiration waveform sweep speed

For thermistor method

- Respiration sensitivity
- Respiration rate and apnea alarm limits
- Respiration waveform sweep speed

The noise reduction for impedance respiration monitoring can be turned on or off and the respiration data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

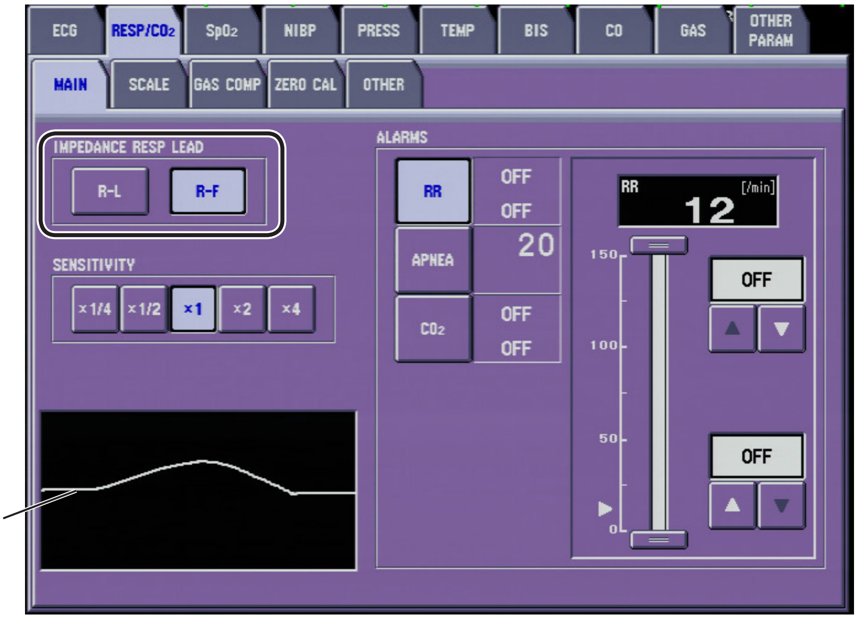
The scale of the respiration rate trendgraph on the home screen is the same scale as the trendgraph of the Review window. Refer to Operator's Manual or Section 6 of the User's Guide Part I.

Changing the Monitoring Lead in Impedance Method

The lead which can be monitored in the impedance method is R-F (RA-LL) or R-L (RA-LA). The selected lead appears on both the home screen and RESP/CO_2 window.

1. Display the MAIN page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → MAIN tab.

2. Select the lead in the <IMPEDANCE RESP LEAD> box. Select the lead with the larger respiration amplitude and smaller heart beat.


ECG
RESP/CO₂
SpO₂
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE RESP LEAD
R-L
R-F
SENSITIVITY
×1/4
×1/2
×1
×2
×4
ALARMS
RR
OFF
OFF
APNEA
20
CO₂
OFF
OFF
RR
[/min]
12
150
100
50
0
OFF
OFF

Respiration waveform

3. Press the [Home] key to return to the home screen.

Changing the Respiration Sensitivity

The sensitivity determines the size of the waveform on both the screen and recording paper.

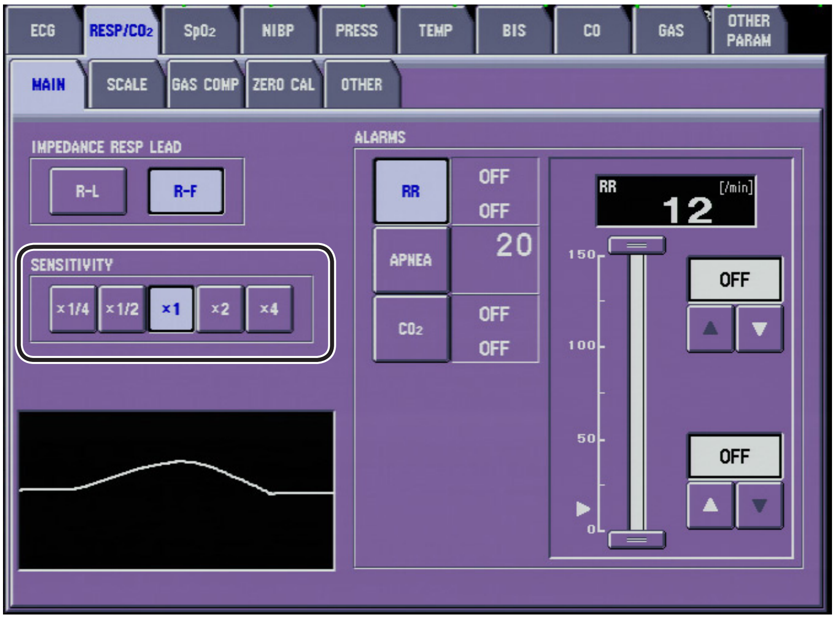
The respiration waveform amplitude differs according to the sensitivity and the NOISE REDUCTION ON IMPEDANCE RESP setting on the SYSTEM SETUP window. The following amplitudes for the respiration rate can be counted. Refer to Section 3 of the Administrator's Guide for the NOISE REDUCTION ON IMPEDANCE RESP setting.

NOISE REDUCTION ON IMPEDANCE RESP Setting	Sensitivity	Countable Amplitudes for the Respiration Rate
ON	× 1/4	Larger than 0.375 mm
	× 1/2	Larger than 0.75 mm
	× 1	Larger than 1.5 mm
	× 2	Larger than 3 mm
	× 4	Larger than 6 mm
OFF	All sensitivities	Larger than 10 mm

In thermistor method, countable amplitudes for the respiration rate is the same as when the NOISE REDUCTION ON IMPEDANCE RESP setting is set to ON.

1. Display the MAIN page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → MAIN tab.

2. Select the appropriate sensitivity from ×1/4, ×1/2, ×1, ×2 and ×4 in the <SENSITIVITY> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE RESP LEAD
R-L
R-F
SENSITIVITY
×1/4
×1/2
×1
×2
×4
ALARMS
RR
OFF
OFF
APNEA
20
CO2
OFF
OFF
RR
[/min]
12
150
100
50
0
OFF
OFF

3. Press the [Home] key to return to the home screen.

Turning Respiration Measurement On or Off in Impedance Method

Even when respiration measurement is set up, you can turn respiration measurement off if you do not need it. When respiration is turned off, respiration waveform does not appear and the “RESP OFF” message appears on the home screen. When respiration is not available, no respiration data appears.

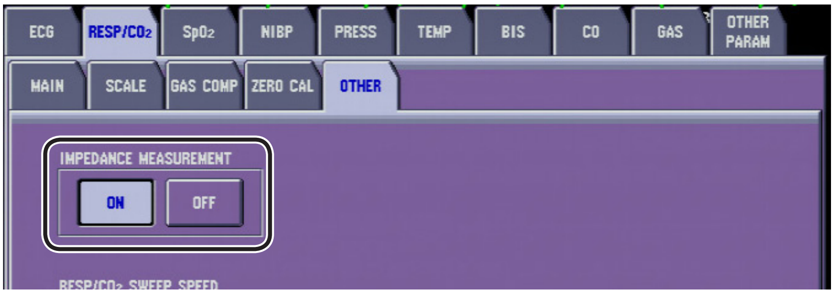
When monitoring respiration in thermistor method and not in impedance method, turn this setting to OFF.

NOTE

When using an ESU, noise is superimposed on the waveform and the respiration measurement cannot be monitored accurately. When respiration monitoring is necessary, use the thermistor method or monitor CO_2.

1. Display the OTHER page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → OTHER tab.

2. Select ON or OFF in the <IMPEDANCE MEASUREMENT> box to turn impedance measurement on or off.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE MEASUREMENT
ON
OFF
RESP/CO2 SWEEP SPEED

3. Press the [Home] key to return to the home screen.

Changing the Respiration Rate and Apnea Alarm Limits

> **CAUTION**
>
> When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

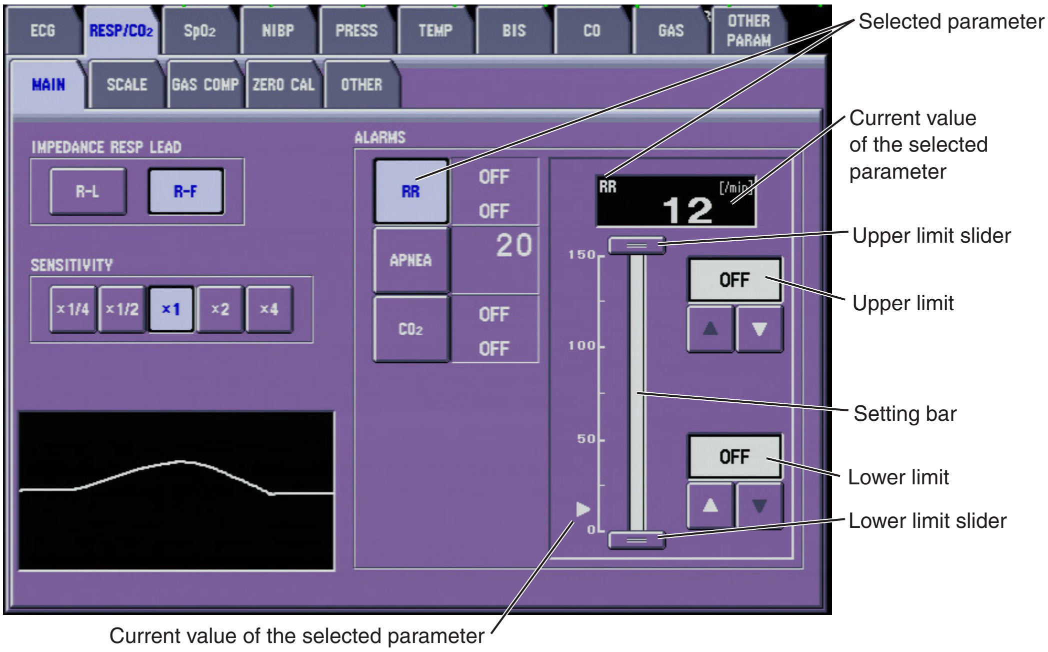
You can set the upper and lower respiration rate and apnea alarm limits on the RESP/CO_2 window. You can set all alarms, including the upper and lower respiration rate and apnea alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I). You can also set the upper and lower respiration rate and apnea alarm limits on the CO_2, GAS and FLOW/Paw windows. (FLOW/Paw window is not available for BSM-6000A series.)

Setting Range

Respiration rate upper limit:	2 to 150 counts/min in 2 counts/min steps, OFF (default setting: OFF)
Respiration rate lower limit:	OFF, 0 to 148 counts/min in 2 counts/min steps (default setting: OFF)
Apnea upper limit:	5 to 40 s in 5 s steps, OFF (default setting: 20)

1. Display the MAIN page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → MAIN tab.

2. Touch the RR key to change the respiration rate alarm setting.
   Touch the APNEA key to change the apnea alarm setting.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE RESP LEAD
R-L
R-F
SENSITIVITY
×1/4
×1/2
×1
×2
×4
ALARMS
RR
OFF
OFF
APNEA
20
CO2
OFF
OFF
RR
[/min]
12
150
100
50
0
OFF
▲
▼
OFF
▲
▼
Selected parameter
Current value of the selected parameter
Upper limit slider
Upper limit
Setting bar
Lower limit
Lower limit slider
Current value of the selected parameter

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

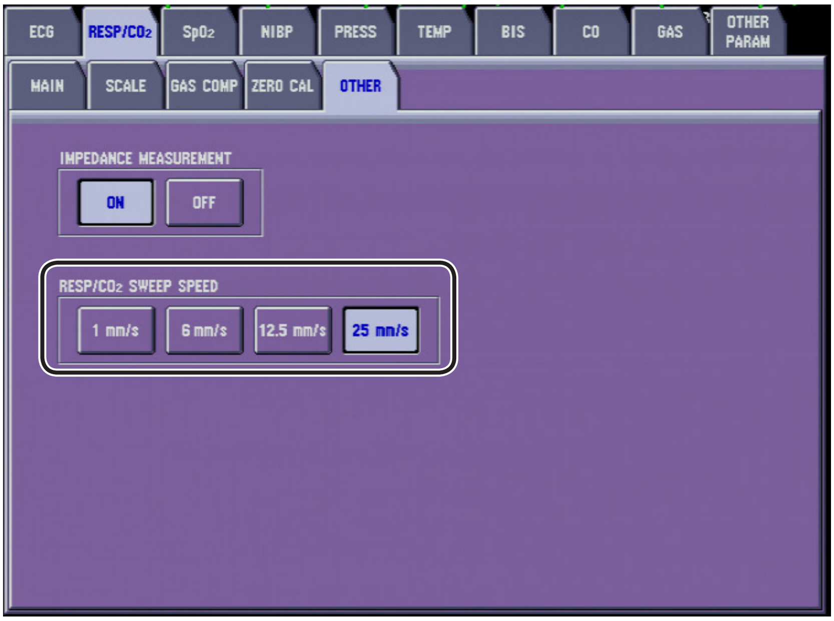
4. Press the [Home] key to return to the home screen.

Changing the Respiration Waveform Sweep Speed

The respiration waveform sweep speed on the screen can be selected. This setting can also be changed on the WAVES page of the DISPLAY window.

1. Display the OTHER page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → OTHER tab.

2. Select the sweep speed from the <RESP/CO_2 SWEEP SPEED> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE MEASUREMENT
ON
OFF
RESP/CO2 SWEEP SPEED
1 mm/s
6 mm/s
12.5 mm/s
25 mm/s

3. Press the [Home] key to return to the home screen.

Section 3 CO_2 Monitoring

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    Sidestream Method 3.3
    Measurement Error with the TG-900P or TG-920P CO_2 Sensor Kit 3.3
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General

On this monitor, CO_2 can be measured by either mainstream method or sidestream method.

To monitor CO_2 by the mainstream method, connect the TG-900P, TG-920P, TG-950P or TG-970P CO_2 sensor kit to the patient's respiration circuit or directly to the patient and connect the CO_2 sensor kit to the MULTI socket or PRESS CO_2 socket on the unit.

NOTE

TG-950P CO_2 sensor kit is not available for BSM-6000A series.

To monitor CO_2 by the sidestream method, the optional AG-400R CO_2 unit or Oridion portable bedside monitor Microcap® is required. To use the AG-400R CO_2 unit, the QF-905P interface is required. For details on the sidestream method, refer to the AG-400R CO_2 unit operator's manual. To connect the Microcap® monitor, the QF-921P interface is required. Microcap is a registered trademark of Oridion Medical Ltd.

NOTE

- AG-400R CO_2 unit is not available for BSM-6000A series.
- Oridion portable bedside monitor Microcap® not available for BSM-6000K series.

Mainstream Method

In the mainstream method, the sensor is located directly in the respiration circuit. There are two types of sensors for different calculation methods.

Semi-quantitative method using the TG-900P or TG-920P CO_2 sensor kit
Measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg (0 kPa).

Quantitative method using the TG-950P or TG-970P CO_2 sensor kit
The CO_2 partial pressure in both inspiration and expiration is measured.

The mainstream CO_2 measurement method has the following merits and limits compared to the sidestream method. Understand these points when performing measurements.

Merits

- No delay in the measurement time.
- Measurement is stable over a long period of time.
- Few measurement troubles due to mixture of water droplets.

Limits

- TG-900P, TG-950P or TG-970P CO_2 sensor kit cannot be used on non-intubated patients.
- Due to the weight of the TG-900P, TG-950P or TG-970P CO_2 sensor kit, load is easily imposed on the tracheal tube.
- The dead space volume is relatively large.

Sidestream Method

A small portion of the breath is continuously sampled from the respiratory circuit or directly from the patient's nostril. CO_2 molecules in the breath sample absorb infrared light at 4.3 µm. The absorption is proportional to the concentration of the CO_2 and the concentration can be determined by comparing the level of absorption to that of a known standard.

The sidestream CO_2 measurement method has the following merits and limits compared to the mainstream method. Understand these points when performing measurements.

NOTE

- AG-400R CO_2 unit is not available for BSM-6000A series.
- Oridion portable bedside monitor Microcap® not available for BSM-6000K series.

Merits

- CO_2 sensor adapter can be used on non-intubated patients.
- Lightweight adapter reduces risk of extubations.

Limits

- Delay in the measurement time.
- Sometimes CO_2 waveform is distorted.
- Long term measurement is difficult due to mixture of water droplets and secretions in the tube.

Measurement Error with the TG-900P or TG-920P CO_2 Sensor Kit

With the TG-900P or TG-920P CO_2 sensor kit, measurements are based on the assumption that the inspiration contains no CO_2 gas. If CO_2 gas mixes in the inspiration, measured values will be lower than normal.

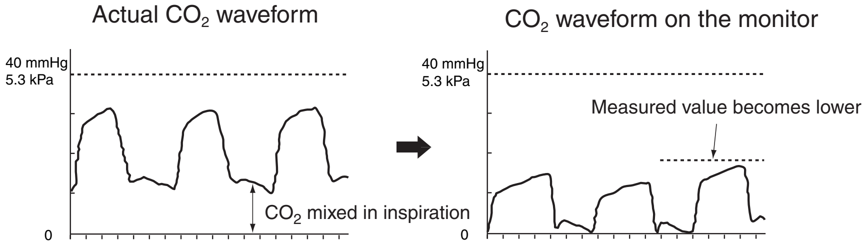
WARNING

With the TG-900P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 by connecting the CO_2 sensor kit to a Jackson Rees circuit, Mapleson D circuit or any other respiration circuit where CO_2 gas may be present during inspiration may result in the acquired data being lower than the actual value.

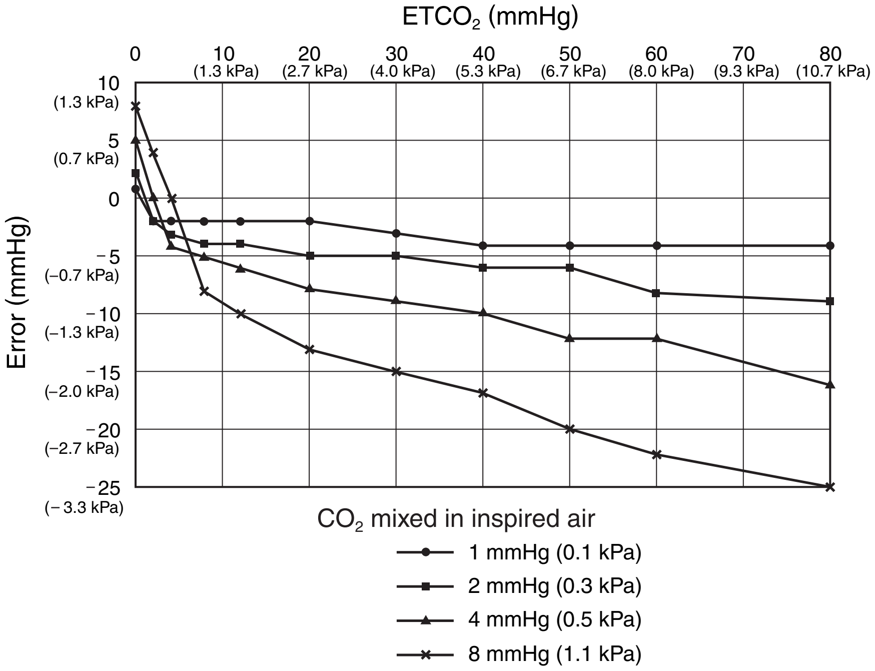
CAUTION

With the TG-920P CO_2 sensor kit, measurements are based on the assumption of no CO_2 gas in the inspiration. The CO_2 concentration in the respiration is calculated by taking the CO_2 concentration in the inspiration as 0 mmHg. Therefore, measuring CO_2 of a patient with an oxygen mask where CO_2 gas may be present in the inspiration gas may result in the acquired data being lower than the actual value.

When CO_2 is mixed in inspiration


Actual CO2 waveform
CO2 waveform on the monitor
40 mmHg
5.3 kPa
0
CO2 mixed in inspiration
40 mmHg
5.3 kPa
Measured value becomes lower
0

Measurement Error when CO_2 is Mixed in the Inspired Air



CAUTION

The TG-900P and TG-920P CO_2 sensor kits do not adjust the measurement value to compensate for different atmospheric pressure. Be careful when reading the value when using the CO_2 sensor kit at high altitudes because the measurement value may be inaccurate.

* The measurement value drops 0.13 kPa (1 mmHg) for 5.33 kPa (40 mmHg) CO_2 gas when an atmospheric pressure drops 3.3 kPa.

Use with Volatile Anesthetic Agents

CAUTION

When using an anesthetic instrument with a volatile anesthetic agent, the CO_2 measurement may be inaccurate.

Volatile anesthetic agents affect the CO_2 value. Be aware of this when using volatile anesthetic agent.

Example: At 1 atmospheric pressure, 5% (38 mmHg, 5.07 kPa) CO_2 and N_2 mixture gas, no condensation

Anesthetic Gas	Concentration	Difference		
		TG-900P	TG-920P	TG-950P
Halothane	4%	+0.9 mmHg +0.12 kPa	+0.6 mmHg +0.08 kPa	+0.2 mmHg +0.03 kPa
Enflurane	5%	+1.5 mmHg +0.20 kPa	+1.5 mmHg +0.20 kPa	+0.4 mmHg +0.05 kPa
Isoflurane	5%	+1.8 mmHg +0.24 kPa	+1.7 mmHg +0.23 kPa	+0.8 mmHg +0.11 kPa
Sevoflurane	6%	+2.8 mmHg +0.37 kPa	+2.7 mmHg +0.36 kPa	+1.3 mmHg +0.17 kPa
Desflurane	24%	+7.0 mmHg +0.93 kPa	+6.6 mmHg +0.88 kPa	+3.2 mmHg +0.43 kPa

Preparing for CO_2 Monitoring

NOTE

- Only one MULTI socket can be used for monitoring CO_2. The sidestream and mainstream methods cannot be monitored at the same time.
- When the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit is connected to the monitor, turn off the AG-920R multigas unit power or disconnect the multi-link cable of the GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit from the monitor while monitoring CO_2 by mainstream method. The CO_2 alarm from mainstream method cannot be indicated when the multigas unit or multigas/flow unit is turned on. (GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit are not available for BSM-6000A series.)
- When using N_2O anesthetic gas (nitrous oxide), set the gas composition on the GAS COMP window. Refer to the “Setting the Inspiration Composition” section.

Preparation Flowchart

Mainstream Method

1. Select the CO_2 sensor kit and airway adapter/nasal adapter.
2. Connect the CO_2 sensor kit to the MULTI socket on the unit.
3. When using a TG-950P or TG-970P CO_2 sensor kit, perform zero calibration (TG-950P CO_2 sensor kit is not available for BSM-6000A series).
4. Connect the CO_2 sensor to the respiration circuit or attach the CO_2 sensor to the patient.
5. Start measurements and change necessary settings.

Sidestream Method

Using AG-400R CO_2 Unit

NOTE

AG-400R CO_2 unit is not available for BSM-6000A series.

1. Prepare the CO_2 unit and connect the unit to the monitor with the QF-905P interface. Refer to the Administrator’s Guide and QF-905P interface operator’s manual.
2. Connect the patient and CO_2 unit with required sensor. Refer to the AG-400R CO_2 unit operator’s manual.
3. Start measurement and change necessary settings.

For details on the sidestream method, refer to the AG-400R CO_2 unit manual.

Using Oridion Portable Bedside Monitor Microcap®

NOTE

Oridion portable bedside monitor Microcap® not available for BSM-6000K series.

1. Set up the Microcap® monitor and connect it to the BSM-6000A series bedside monitor. Refer to the QF-921P interface manual.

2. Connect the Microcap® monitor to the patient. Refer to the Microcap® monitor manual.

3. Start measurement and change necessary settings.

Types of CO_2 Sensor Kits for Mainstream Method

There are three types of CO_2 sensor kit for CO_2 mainstream monitoring.

Model	Method	Attachment
TG-900P	Semi-quantitative	Used on an intubated patient
TG-920P	Semi-quantitative	Attach to the patient nose or used on an intubated patient
TG-950P	Quantitative	Used on an intubated patient
TG-970P	Quantitative	Used on an intubated patient

WARNING

When using the airway adapter or nasal adapter on a patient with low ventilatory volume, the CO_2 may mix in the inspiration due to the airway adapter's dead space, resulting in inaccurate measured values or difficulty in detecting apnea. Perform ventilation taking into consideration the dead space of the adapters.

CAUTION

The CO_2 data may be inaccurate when monitoring a patient with an extremely high respiration rate or irregular respiration. Read the measured values carefully.

CAUTION

Make sure that the gas composition is entered. Otherwise the measurement result may be inaccurate.

CAUTION

When using an anesthetic instrument with a volatile anesthetic agent, the CO_2 measurement may be inaccurate.

CAUTION

Select the airway adapter or nasal adapter taking into consideration the patient weight and ventilation volume. If an inappropriate airway adapter or nasal adapter is used, the resistance in the respiration circuit increases and it causes incorrect measurement value.

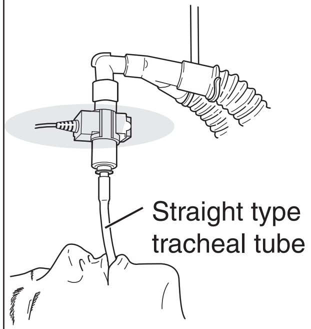
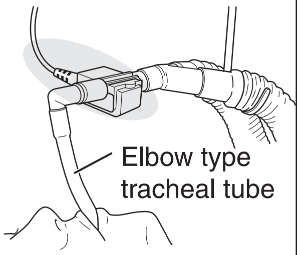
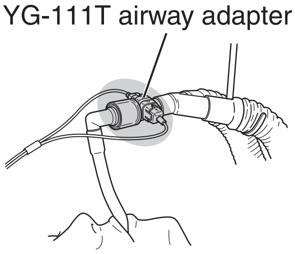
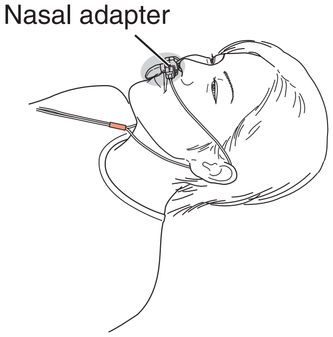
NOTE

- The measurement may be inaccurate when monitored in the following conditions. Read the measured values carefully.
  - When used in environments with high concentration nitrous oxide gas.
  - When used in environments with sudden temperature changes.
  - When used in environments with severe humidity.

NOTE

For intubated patients, connect the CO$_2$ sensor as in the following example so that the sensor does not touch the patient.

Connection example

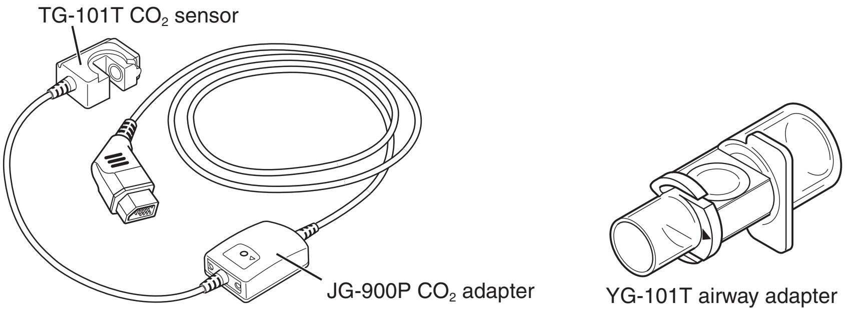
For intubated patients	For non-intubated patients
TG-900P/TG-950P/TG-970P  Straight type tracheal tube  Elbow type tracheal tube TG-920P  YG-111T airway adapter	TG-920P  Nasal adapter

NOTE

TG-950P CO$_2$ sensor kit is not available for BSM-6000A series.

TG-900P CO_2 Sensor Kit

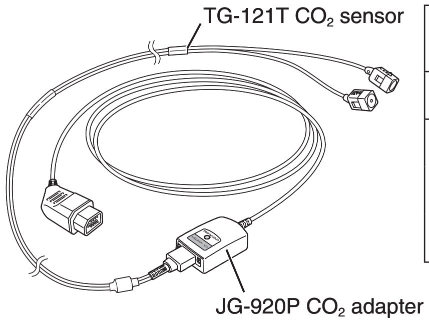
The TG-900P CO_2 sensor kit measures the partial pressure of the expired CO_2 of an intubated patient by the semi-quantitative method. It consists of a TG-101T CO_2 sensor and JG-900P CO_2 adapter. It requires a YG-101T airway adapter for monitoring CO_2.



Model	Weight	Dead space volume	Code No.
YG-101T	10 kg or more	5 cc	R801

TG-920P CO_2 Sensor Kit

The TG-920P CO_2 sensor kit measures the partial pressure of the expired CO_2 of a patient by the semi-quantitative method. This CO_2 sensor kit can be used on both intubated and not intubated patients. It consists of a TG-121T CO_2 sensor and JG-920P CO_2 adapter. It requires a YG-120T, YG-121T or YG-122T nasal adapter when attached on a patient who is not intubated or YG-111T airway adapter when attached on an intubated patient for monitoring CO_2.



Type of Adapter	Model	Weight	Dead Space Volume	Code No.
Airway adapter	YG-111T	7 kg or more	4 mL	R804
Nasal adapter	YG-120T	10 kg or more	1.2 mL	V921
	YG-121T			V922
	YG-122T			V923

WARNING

The only oxygen cannula that can be used with YG-122T is manufactured by HUDSON RCI®. Do not use any other oxygen cannula. Other oxygen cannulas cannot be attached and oxygen cannot be delivered to the patient through the nostrils.

WARNING

Check that the oxygen cannula tube is not bent, broken, or blocked by the nasal tube. If the ends of the oxygen cannula tube turn too far up or down, it causes insufficient O_2 supply or the CO_2 value may be incorrect.

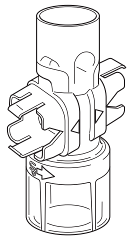
WARNING

- When you use YG-122T together with an oxygen cannula, check that the oxygen cannula is correctly attached on the patient by referring to other parameters and by observing the patient periodically.
- If arterial oxygen saturation does not increase, immediately stop using the oxygen cannula with the CO_2 sensor kit and select another way to supply oxygen.

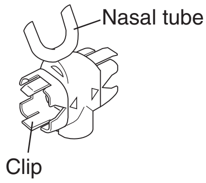
CAUTION

When using the YG-121T/YG-122T nasal adapter on a patient with bleeding disorder, poor general medical condition or malnutrition, observe the patient condition all the time. The mouth guide touches the mouth and may cause pressure sores.

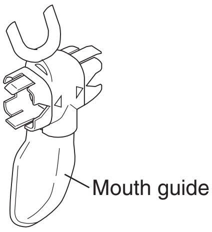
YG-111T airway adapter



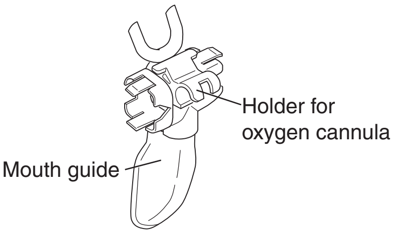
YG-120T
(for nasal breathing)



YG-121T
(for naso-oral)

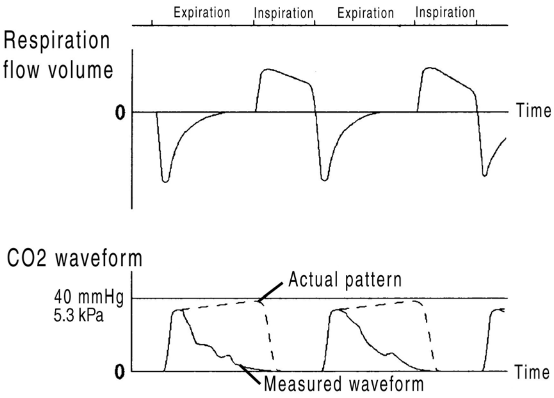


YG-122T
(for oxygen cannula)



When Using an Oxygen Cannula

As the graphs show, the expired volume is decreased at the end of expiration. If too much oxygen is supplied or oxygen is directly delivered to the nose, the oxygen flow affects the expired gas flow. Therefore, the actual CO$_2$ waveform will be inaccurate (the solid line in the graph) compared with the typical pattern (the dashed line).

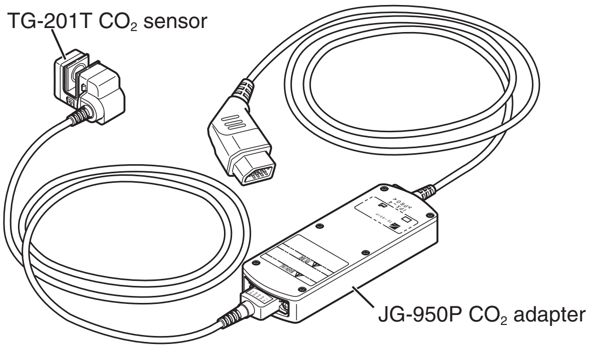


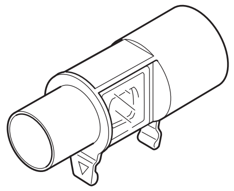
TG-950P CO_2 Sensor Kit

The TG-950P CO_2 sensor kit measures the partial pressure of the expired CO_2 of an intubated patient by the quantitative method. It consists of a TG-201T CO_2 sensor and JG-950P CO_2 adapter. It requires a YG-201T or YG-202T airway adapter for monitoring CO_2.

NOTE

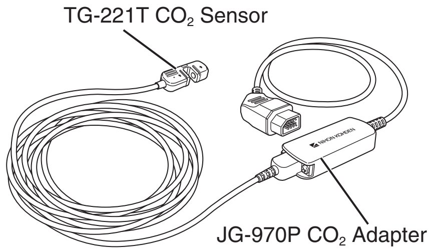
TG-950P CO_2 sensor kit is not available for BSM-6000A series.

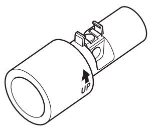

TG-201T CO_2 sensor
JG-950P CO_2 adapter


YG-201T/YG-202T airway adapter

TG-970P CO_2 Sensor Kit

The TG-970P CO_2 sensor kit measures the partial pressure of the expired CO_2 of an intubated patient by the quantitative method. It consists of a TG-221T CO_2 sensor and JG-970P CO_2 adapter. It requires a YG-211T airway adapter for monitoring CO_2.


TG-221T CO_2 Sensor
JG-970P CO_2 Adapter


YG-211T Airway Adapter

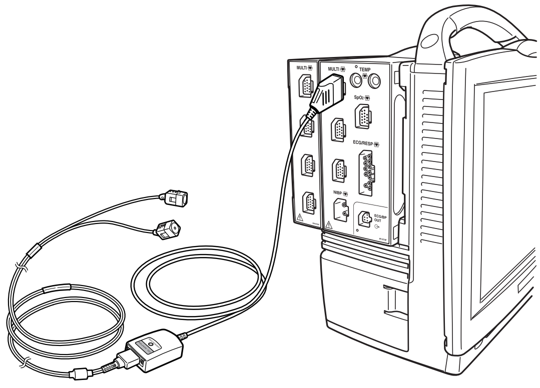
Model	Patient	Weight	Dead space volume	Code No.
YG-211T	Adult/pediatric	7 kg or more	4 mL	R805

Connecting the CO_2 Sensor Kit to the Unit

Connect the CO_2 sensor kit to the MULTI or PRESS CO_2 socket on the unit. Only one MULTI or PRESS CO_2 socket can be used for monitoring CO_2.

NOTE

- Only one MULTI socket or PRESS CO_2 socket can be used for monitoring CO_2. The sidestream and mainstream methods cannot be monitored at the same time.
- When the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit is connected to the monitor, turn off the AG-920R multigas unit power or disconnect the multi-link cable of the GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit from the monitor while monitoring CO_2 by mainstream method. The CO_2 alarm from mainstream method cannot be indicated when the multigas unit or multigas/flow unit is turned on. (GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit are not available for BSM-6000A series.)



When connecting the TG-920P CO_2 sensor kit

Connecting the CO_2 Sensor Kit to the Respiration Circuit

Connect the CO_2 sensor kit to the patient or respiration circuit by referring to the CO_2 sensor kit manual.

Performing Zero Calibration when Using a TG-950P or TG-970P CO_2 Sensor Kit

NOTE

TG-950P CO_2 sensor kit is not available for BSM-6000A series.

When using the TG-950P or TG-970P CO_2 sensor kit, perform zero calibration in the following conditions.

- When the airway adapter is replaced with a new one.
- When a different type of airway adapter is used.
- When the operating temperature changes.
- When the measurement room is changed.
- Whenever necessary.

Zero calibration can be performed in two ways: calibration with air and calibration with N_2 gas. Both methods are performed on the RESP/CO_2 window.

- Calibration with air
  Expose the airway adapter to air. Calibrates with about 0.2 mmHg (0.03 kPa) CO_2 in the air.
- Calibration with N_2 gas
  Flow N_2 gas into the airway adapter.

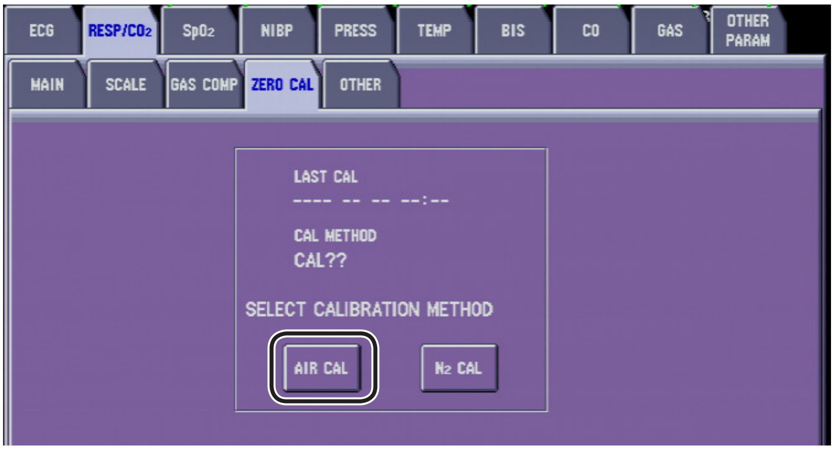
NOTE

The calibrated value is saved in memory in the connector of the CO_2 sensor kit. Once calibrated, you don't need to calibrate again when connecting the CO_2 sensor kit to the different socket of a different unit.

Calibrating by Air

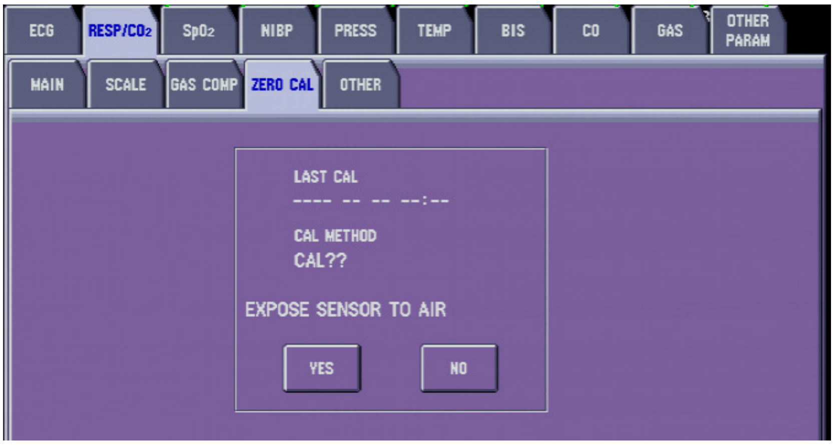
1. Display the ZERO CAL page of the RESP/CO_2 window. The TG-950P CO_2 sensor kit must be connected to the monitor for the ZERO CAL page to be displayed.
   Press [Menu] key → RESP/CO_2 key → ZERO CAL tab.

2. Select AIR CAL under <SELECT CALIBRATION METHOD>. The "EXPOSE SENSOR TO AIR" message appears.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
AIR CAL
N2 CAL

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
SELECT CALIBRATION METHOD

3. Expose the airway adapter to air and touch the YES key to start calibration.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
YES
NO

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
EXPOSE SENSOR TO AIR

When the "CALIBRATION COMPLETE" message is displayed, the calibration is complete. The calibrated date and time appears.

4. Reconnect the airway adapter to the respiration circuit. CO_2 can be monitored.

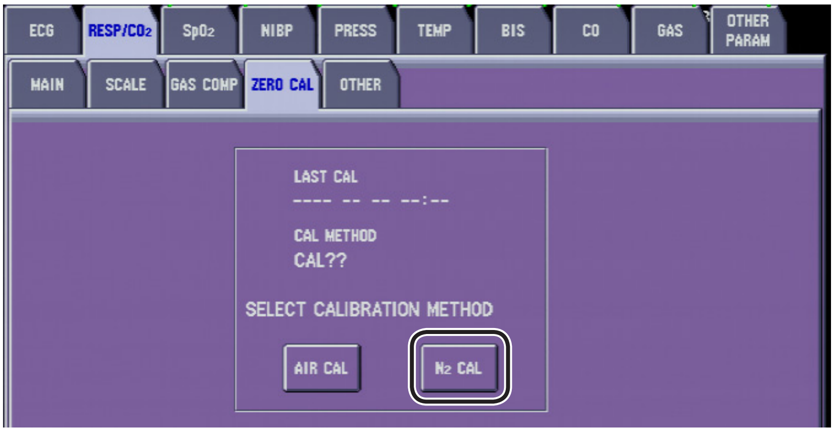
Calibrating with N_2 Gas

For handling the N_2 gas cylinder, refer to the N_2 gas manual.

1. Connect the airway adapter to the N_2 gas cylinder.

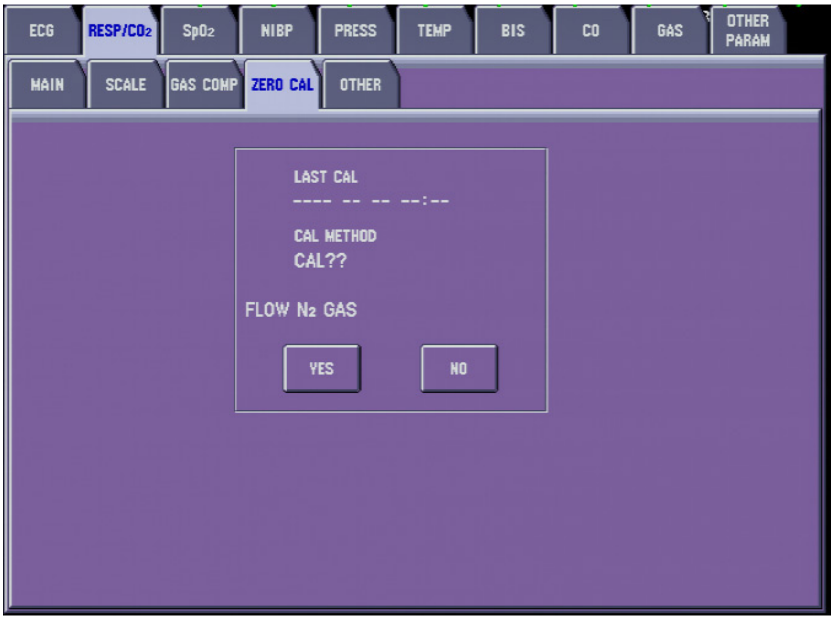
2. Display the ZERO CAL page of the RESP/CO_2 window. The TG-950P CO_2 sensor kit must be connected to the monitor for the ZERO CAL page to be displayed.
   Press [Menu] key → RESP/CO_2 key → ZERO CAL tab.

3. Select N_2 CAL under <SELECT CALIBRATION METHOD>. The “FLOW N_2 GAS” message appears.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
AIR CAL
N2 CAL

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
SELECT CALIBRATION METHOD

4. Open the N_2 gas cylinder so that the N_2 gas flows into the airway adapter and touch the YES key to start calibration.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
YES
NO

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
FLOW N2 GAS

When the “CALIBRATION COMPLETE” message is displayed, the calibration is complete. The calibrated date and time appears.

5. Reconnect the airway adapter to the respiration circuit. CO_2 can be monitored.

Monitoring CO_2

After completing the preparation, CO_2 data and waveform appear on the screen.

CAUTION

When the “CO_2 CHANGE ADAPTER” or “CO_2 CHANGE SENSOR” message is displayed, check the CO_2 sensor kit and replace it if necessary. CO_2 cannot be monitored while the message is displayed.

CAUTION

When using an anesthetic instrument with a volatile anesthetic agent, the CO_2 measurement may be inaccurate.

NOTE

When the AG-920R, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit is connected to the monitor, turn off the AG-920R multigas unit power or disconnect the multi-link cable of the GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit from the monitor while monitoring CO_2 by mainstream method. The CO_2 alarm from mainstream method cannot be indicated when the multigas unit or multigas/flow unit is turned on. (GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit are not available for BSM-6000A series.)

CO_2 Information on the Home Screen

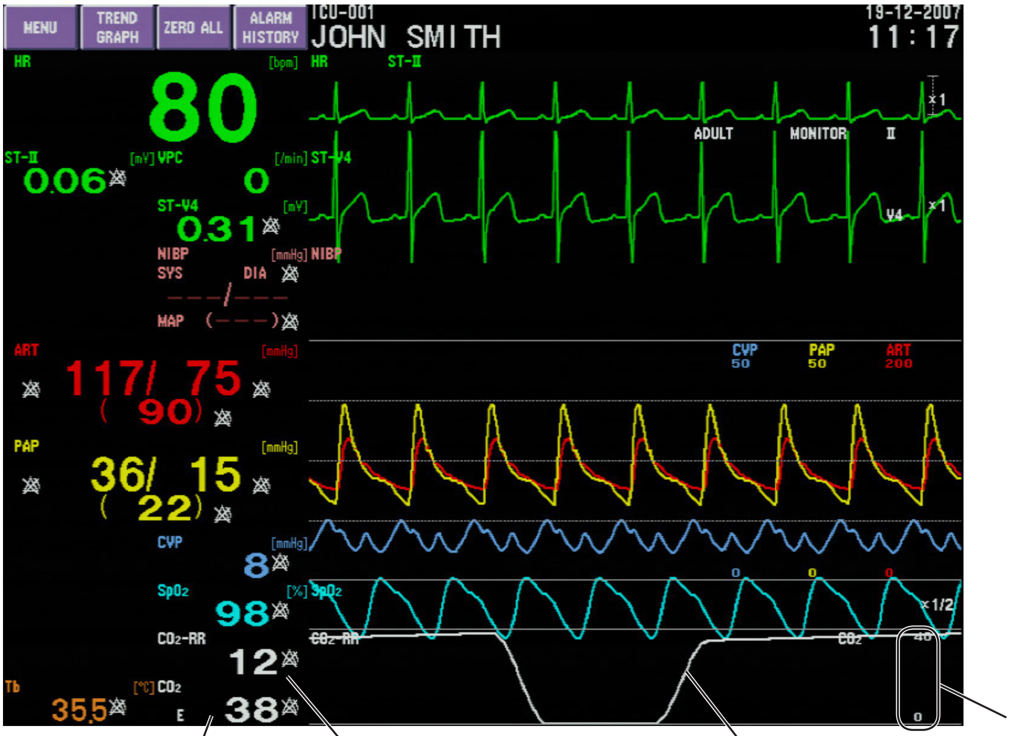
When Using a TG-900P or TG-920P CO_2 Sensor Kit

NOTE

This monitor performs calibration automatically at periodic interval and in the following conditions.

- At the monitor power on
- Patient’s first respiration
- The airway adapter/nasal adapter is removed from the CO_2 sensor and connected again
- Respiration stopped for 20 seconds
- Signal changed rapidly due to temperature change

During calibration, the CO_2 waveform appears as the calibrated waveform, but the respiration rate and measured value are not affected.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
19-12-2007
11:17
HR [bpm]
80
ST-II [mV]
0.06
VPC [/min]
0
ST-V4 [mV]
0.31
NIBP [mmHg]
SYS DIA
---/---
MAP (---)
ART [mmHg]
117/ 75
(90)
PAP [mmHg]
36/ 15
(22)
CVP [mmHg]
8
SpO2 [%]
98
CO2-RR
12
Tb [°C]
35.5
CO2
E
38
HR
ST-II
×1
ADULT
MONITOR
II
ST-V4
V4
×1
NIBP
CVP 50
PAP 50
ART 200
0
0
0
SpO2
×1/2
CO2-RR
CO2
40
0

End tidal CO_2

Respiration rate from CO_2

CO_2 waveform

Scale of CO_2 waveform

When Using a TG-950P or TG-970P CO_2 Sensor Kit, AG-400R CO_2 Unit or Oridion Portable Bedside Monitor Microcap®

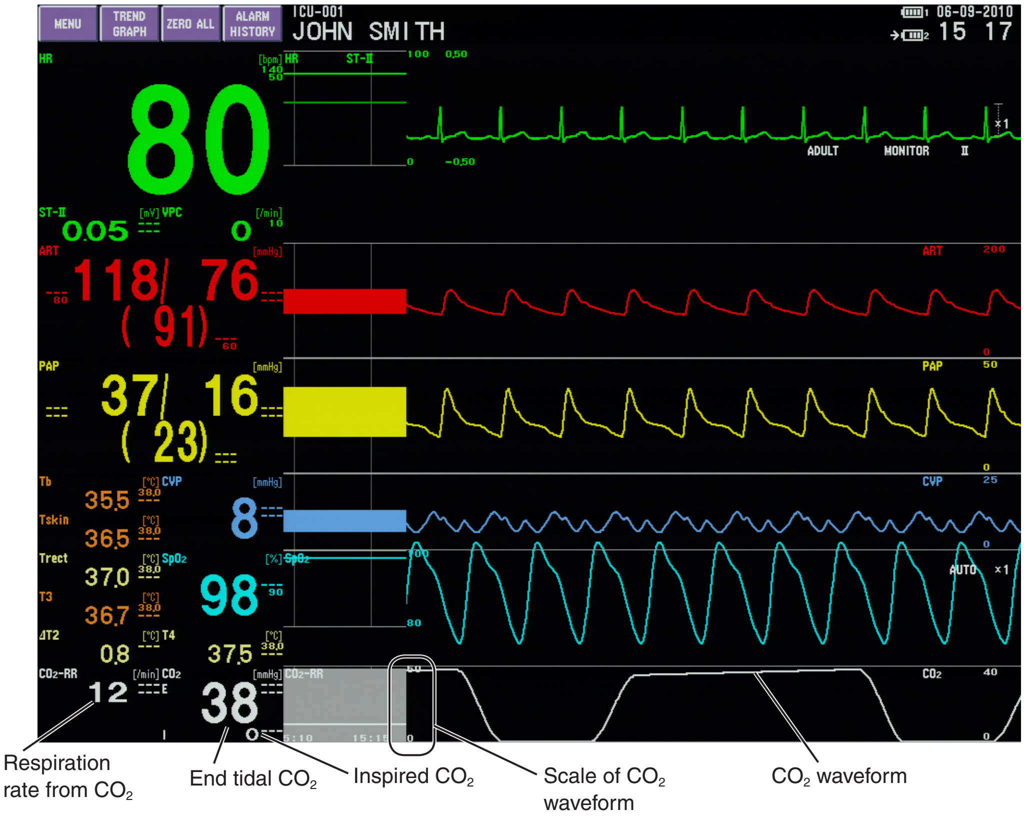
WARNING

Alarms are set on the bedside monitor and Microcap® monitor individually. When an alarm setting is changed on one instrument, the same setting change is not automatically applied to the other instrument.

NOTE

Perform calibration in the following conditions.

- When the airway adapter is replaced with a new one.
- When a different type of airway adapter is used.
- When the operating temperature changes.
- When the measurement room is changed.
- Whenever necessary.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
06-09-2010
15 17
HR
80
ST-II
0.05
VPC
0
ART
118/ 76
(91)
PAP
37/ 16
(23)
Tb
35.5
Tskin
36.5
Trect
37.0
T3
36.7
ΔT2
0.8
CVP
8
SpO2
98
T4
37.5
CO2-RR
12
CO2
38
0
ADULT
MONITOR
II
AUTO
Respiration rate from CO_2
End tidal CO_2
Inspired CO_2
Scale of CO_2 waveform
CO_2 waveform

Changing CO_2 Settings

Change the settings on the RESP/CO_2 window. The following settings can be changed for CO_2 monitoring.

- Scale
- Respiration rate, apnea and CO_2 alarm settings
- Inspiration composition
- CO_2 waveform sweep speed

The CO_2 unit can be set to mmHg or kPa on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.

The CO_2 data display color and CO_2 waveform fill in or not can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

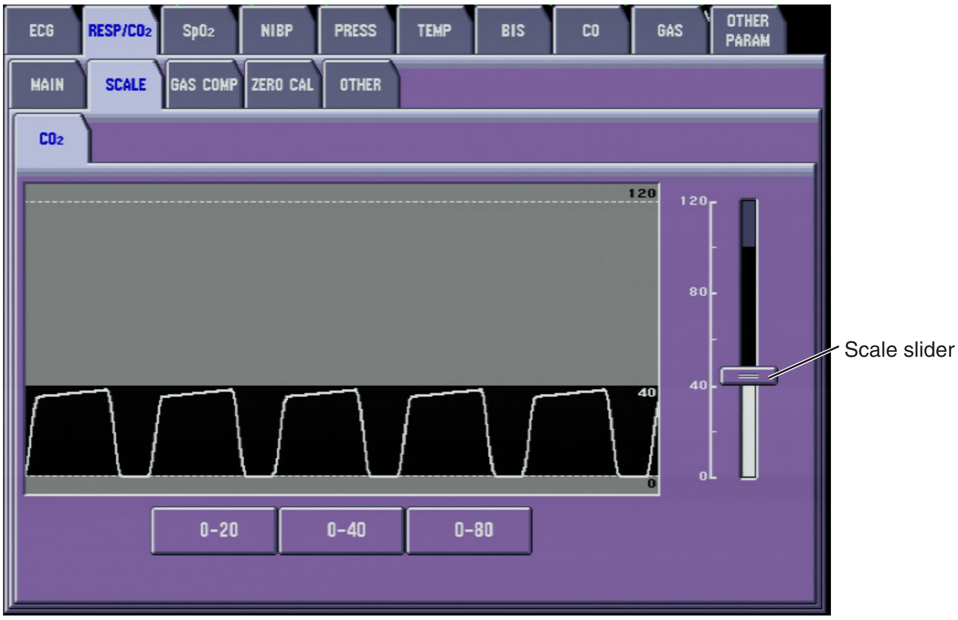
Changing the Scale

The scale can be changed for the CO_2 waveform. The same scale is used on both the home screen and RESP/CO_2 window.

The CO_2 scale can also be changed on the TREND GRAPH window.

1. Display the SCALE page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → SCALE tab.

2. Select the scale by touching the desired scale key. You can adjust the scale using the scale slider.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
CO2
120
40
0
120
80
40
0
Scale slider
0-20
0-40
0-80

3. Press the [Home] key to return to the home screen.

Changing the CO_2, Respiration Rate and Apnea Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower CO_2, respiration rate and apnea alarm limits on the RESP/CO_2 window. You can set all alarms, including the upper and lower CO_2, respiration rate and apnea alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I). You can also set upper and lower CO_2, respiration rate and apnea alarm limits on the RESP, GAS and FLOW/Paw windows. (FLOW/Paw window is not available for BSM-6000A series.) You can also set upper and lower CO_2 alarm limits on the GAS window.

Setting Range

CO_2(E) upper limit:	2 to 99 mmHg in 1 mmHg steps (1.0 to 13.5 kPa in 0.5 kPa steps), OFF (default setting: OFF)
CO_2(E) lower limit:	OFF, 1 to 98 mmHg in 1 mmHg steps (0.5 to 13.0 kPa in 0.5 kPa steps) (default setting: OFF)
CO_2(I) upper limit*:	1 to 5 mmHg in 1 mmHg steps (0.1 to 0.7 kPa in 0.1 kPa steps), OFF (default setting: OR-3 mmHg (0.4 kPa), ICU/NICU-OFF)
Respiration rate upper limit:	2 to 150 counts/min in 2 counts/min steps, OFF (default setting: OFF)
Respiration rate lower limit:	OFF, 0 to 148 counts/min in 2 counts/min steps (default setting: OFF)
Apnea upper limit:	5 to 40 s in 5 s steps, OFF (default setting: 20)

* CO_2(I) alarm upper limit can be set when using a TG-950P CO_2 sensor kit or when monitoring CO_2 in sidestream method. TG-950P CO_2 sensor kit and AG-400R CO_2 unit are not available for BSM-6000A series.

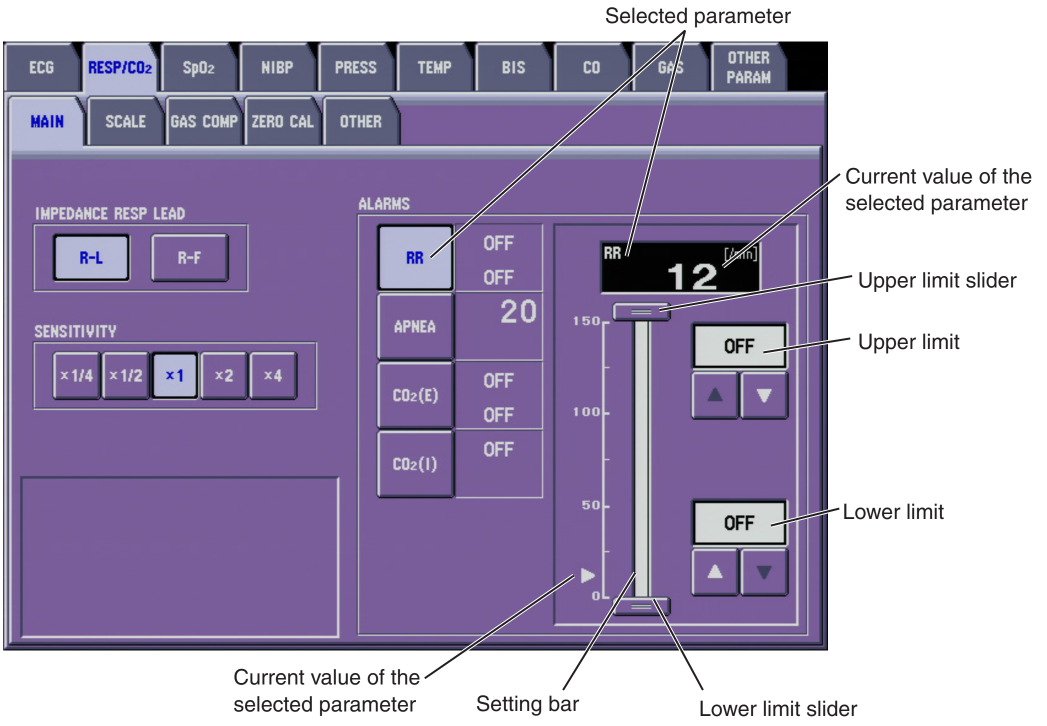
1. Display the MAIN page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → MAIN tab.

2. Touch the CO_2 key to change the end tidal CO_2 alarm setting.

   Touch the CO_2(I) key to change the inspired CO_2 alarm setting. This setting is only available when CO_2 is monitored with TG-950P CO_2 sensor kit or by sidestream method.

   Touch the RR key to change the respiration rate alarm setting.

   Touch the APNEA key to change the apnea alarm setting.


Selected parameter
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE RESP LEAD
R-L
R-F
SENSITIVITY
×1/4
×1/2
×1
×2
×4
ALARMS
RR
OFF
OFF
APNEA
20
CO2(E)
OFF
OFF
CO2(I)
OFF
RR
[/min]
12
150
100
50
0
OFF
OFF
Current value of the selected parameter
Upper limit slider
Upper limit
Lower limit
Current value of the selected parameter
Setting bar
Lower limit slider

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Setting the Inspiration Composition

When N_2O is mixed in the inspiration or when a high concentration of oxygen is inspired, sensitivity of CO_2 absorbing infrared ray is affected, and as a result measurements cannot be performed correctly. When using anesthetic gas or a respirator, set the inspiration composition. The monitor corrects the CO_2 concentration automatically according to the setting.

This setting is not required when monitoring in sidestream method.

CAUTION

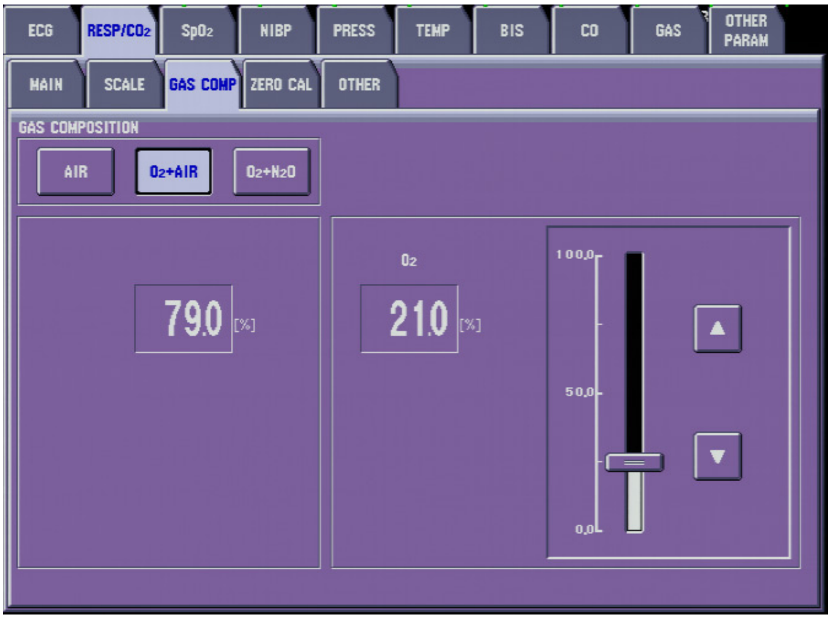
Make sure that the gas composition is entered. Otherwise the measurement result may be inaccurate.

CAUTION

When using an anesthetic instrument with a volatile anesthetic agent, the CO_2 measurement may be inaccurate.

1. Display the GAS COMP page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → GAS COMP tab.

2. Set the composition of the inspired gas.
   - When not using gas that influences measurement
     → Select AIR.
   - When using a respirator or high concentration of oxygen
     → Select O_2+AIR and set the O_2 gas ratio on the O_2 setting bar.
   - When using anesthetic gas
     → Select O_2+N_2O and set the gas ratio on the O_2 and N_2 setting bar.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
GAS COMPOSITION
AIR
O2+AIR
O2+N2O
79.0 [%]
O2
21.0 [%]
100.0
50.0
0.0

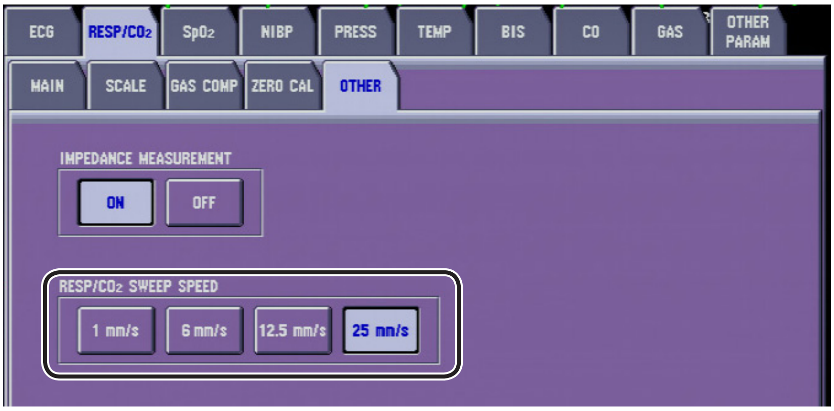
3. Press the [Home] key to return to the home screen.

Changing the CO_2 Waveform Sweep Speed

The CO_2 waveform sweep speed on the screen can be selected. This setting can also be changed on the WAVES page of the DISPLAY window.

1. Display the OTHER page of the RESP/CO_2 window.
   Press [Menu] key → RESP/CO_2 key → OTHER tab.

2. Select the sweep speed from the <RESP/CO_2 SWEEP SPEED> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
GAS COMP
ZERO CAL
OTHER
IMPEDANCE MEASUREMENT
ON
OFF
RESP/CO2 SWEEP SPEED
1 mm/s
6 mm/s
12.5 mm/s
25 mm/s

3. Press the [Home] key to return to the home screen.

Inspection of Measuring Accuracy

Daily Inspection of Measuring Accuracy

Perform daily accuracy inspection using your own respiration.

Put the larger end of the airway adapter (side for connecting to the patient’s mask and tracheal tube) into your mouth and after stabilizing breathing, breathe in the same way as in the resting state at a rate of 5 seconds per breath (12 breaths/min). Breathing too quickly or taking deep breaths will disable standard measurements.

The standard $ETCO_2$ concentration is 40 mmHg (5.3 kPa). Check that the CO_2 gas concentration display is from 35 to 45 mmHg (4.7 to 6.0 kPa).

Inspection of Measuring Accuracy (Precise Method)

Check the measurement accuracy every half year and whenever you suspect the monitor is not reading correctly. This procedure does not calibrate the CO_2 sensor. It only checks the measurement accuracy. If the measurement accuracy is not appropriate, contact your Nihon Kohden representative.

For details, refer to Service Manual.

Section 4 SpO_2 Monitoring

For monitoring SpO_2, the manufacturer of the probes differ depending on the model of the AY series input unit.

AY-660P/AY-661P/AY-663P/AY-671P/AY-673P input unit:
Nihon Kohden (refer to Section 4-1)
AY-651P/AY-653P input unit: Nellcor (refer to Section 4-2)
AY-631P/AY-633P input unit: Masimo (refer to Section 4-3)

AY-660P, AY-661P and AY-663P input units are not available for BSM-6000A series.

Section 4-1 SpO$_2$ Monitoring on AY-660P/661P/663P/671P/673P Input Unit

General 4.1.2
    When Monitoring Dual SpO$_2$ 4.1.4
    Silencing SpO$_2$ Alarm 4.1.4
Preparing for SpO$_2$ Monitoring 4.1.5
  Preparation Flowchart 4.1.5
  Selecting a Probe 4.1.5
    Nihon Kohden Reusable Probes 4.1.5
    Nihon Kohden Disposable Probes 4.1.6
  Connecting Cables and Attaching the Probes 4.1.7
    Connecting Cable to the Unit 4.1.7
    Attaching the Probe to the Patient 4.1.8
Monitoring SpO$_2$ 4.1.9
  SpO$_2$ Information on the Home Screen 4.1.9
Changing SpO$_2$ Settings 4.1.10
  Changing the Sensitivity 4.1.11
  Changing the SpO$_2$ and Pulse Rate Alarm Limits 4.1.11
  Changing the Sync Sound Source 4.1.13
  Selecting Sync Sound Pitch 4.1.14
  Selecting the Response Mode 4.1.15
  Selecting SpO$_2$ Sensitivity Mode 4.1.16
  Displaying Pulse Rate and ΔSpO$_2$ on the Home Screen 4.1.17

NOTE

AY-660P, AY-661P and AY-663P input units are not available for BSM-6000A series.

General

To monitor SpO_2, attach a probe to the patient and connect it to the SpO_2 socket on the input unit.

To monitor SpO_2 at two site (dual SpO_2), attach a probe to the patient and connect it to the SpO_2 socket on the AY-661P, AY-663P, AY-671P or AY-673P input unit and attach another probe to the patient and connect it to the MULTI socket on the AY-661P, AY-663P, AY-671P, AY-673P input unit, AA-672P or AA-674P smart expansion unit or JA-694PA data acquisition unit. The MULTI socket on the AY-660P input unit cannot be used.

To connect a Nihon Kohden probe to the MULTI socket, the JL-500P1 or JL-500P2 SpO_2 adapter is required. More than one JL-500P1 or JL-500P2 SpO_2 adapter cannot be connected to the monitor.

When using an AY-660P input unit with a JA-694PA data acquisition unit, the SpO_2-2 cannot be monitored by the MULTI socket on the AY-660P input unit, but can be monitored by the MULTI socket on the JA-694PA data acquisition unit.

The AY-660P, AY-661P or AY-663P input units and JL-500P2 SpO_2 adapter are not available for BSM-6000A series.

WARNING

SpO_2 measurement may be incorrect in the following cases.

- When the patient's carboxyhemoglobin or methemoglobin increases abnormally.
- When dye is injected in the blood.
- When using an electrosurgical unit.
- During CPR.
- When measuring at a site with venous pulse.
- When there is body movement.
- When the pulse wave is small (insufficient peripheral circulation).

WARNING

Check the circulation condition by observing the skin color at the measurement site and pulse waveform. Change the measurement site every 8 hours for disposable probes and every 4 hours for reusable probes (every 8 hours for TL-631T3 probe). The skin temperature may increase at the attached site by 2 or 3°C (4 or 5°F) and cause a burn or pressure necrosis. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.

- Patient with a fever
- Patient with peripheral circulation insufficiency
- Neonate or low birth weight infant with delicate skin

WARNING

When not monitoring SpO_2, disconnect the SpO_2 connection cord from the input unit. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.

WARNING

When monitoring SpO_2 of a patient who is receiving photodynamic therapy, the light from the finger probe sensor may cause a burn. Photodynamic therapy uses a photosensitizing agent that has a side effect of photosensitivity.

The SpO_2 probe manufactured by Nihon Kohden have two wavelengths with peaks in the range of 650 and 950 nm. The maximum light intensity is less than 5.5 mW.

WARNING

- When using the TL-201T finger probe, do not fasten the probe and cable to the finger by wrapping with tape. This may cause burn, congestion or pressure necrosis from poor blood circulation.
- When using probes other than the TL-201T finger probe, to avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.

CAUTION

Turn off the power of mobile phones, small wireless devices and other devices which produce strong electromagnetic interference around a patient (except for devices allowed by the hospital administrator). Radio waves from devices such as mobile phones or small wireless devices may be mistaken as pulse waves and the displayed data may be incorrect.

CAUTION

Normal external light does not affect monitoring but strong light such as a surgical light or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.

CAUTION

While a patient is on medication which causes vasodilation, the pulse waveform may change and in rare cases the SpO_2 value might not be displayed.

CAUTION

Only use the specified probes. Otherwise, SpO_2 cannot be monitored.

NOTE

Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter. The SpO_2 measurement may be incorrect.

When Monitoring Dual SpO_2

CAUTION

When two probes are attached too close to each other, the light from the probes interferes with each other and SpO_2 cannot be monitored properly. Make sure that there is no light interference when attaching two probes.

NOTE

SpO_2-2 cannot be monitored by using the MULTI socket on the AY-660P input unit.

Dual SpO_2 Function (SpO_2 Measurement at Two Sites)

When there is a right → left shunt in a patent ductus arteriosus (PDA), there will be a difference in oxygen saturation between the right upper limb (pre-ductal) and lower limb (post-ductal).

By connecting two SpO_2 probes to the bedside monitor, SpO_2 can be monitored at the upper limb and lower limb, and the SpO_2 difference (ΔSpO_2) can be calculated. The ΔSpO_2 is calculated by subtracting the SpO_2 value from the probe connected to the MULTI socket (post-ductal) from the SpO_2 value from the probe connected to the SpO_2 socket (pre-ductal).

When there is a right → left shunt through the ductus arteriosus, the SpO_2 of the lower limb is lower than the SpO_2 of the right upper limb. Therefore, when the SpO_2 probe connected to the SpO_2 socket is attached to a right upper limb and the probe connected to the MULTI socket is attached to a lower limb, the ΔSpO_2 is indicated as a plus value.

PPHN (Persistent Pulmonary Hypertension of Newborn) and Dual SpO_2

PPHN (Persistent Pulmonary Hypertension of Newborn) is a critical disease where elevated pulmonary vascular resistance and serious pulmonary hypertension remain after birth and there is a large right → left shunt through the ductus arteriosus.

For PPHN from the right → left shunt in a patent ductus arteriosus (PDA), it is reported that monitoring the difference in SpO_2 between right upper limb (preductal) and lower limb (post-ductal) is useful to diagnose PPHN, decide the timing of starting/stopping treatment, and decide the operation schedule.

Silencing SpO_2 Alarm

This function is only available for BSM-6000A series. When the <SILENCE SpO_2 ALARM> on the ALARM window of the SYSTEM SETUP window is set to ON, a second occurring SpO_2 alarm can be silenced when the [Silence Alarms] key is pressed. Refer to Section 3 of the Administrator’s Guide.

NOTE

When the <SILENCE SpO_2 ALARM> is set to ON and the monitored SpO_2 value is close to the SpO_2 upper and lower alarm limit setting, you may have to press the [Silence Alarm] key several times to silence the SpO_2 alarm.

Preparing for SpO$_2$ Monitoring

Preparation Flowchart

1. Select the probe.
2. Connect the probe to the SpO$_2$ connection cord and connect the SpO$_2$ connection cord to the SpO$_2$ socket on the unit.

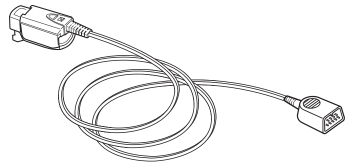
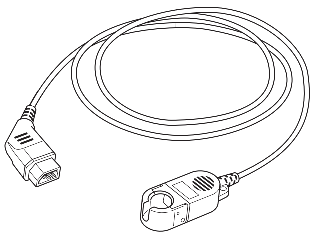
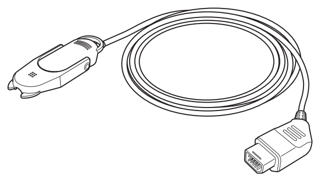
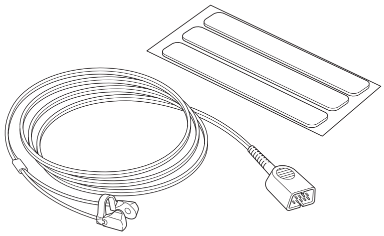
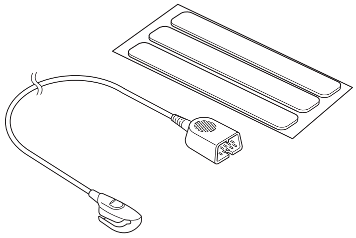
   For SpO$_2$ measurement at two sites, connect the probe to the SpO$_2$ adapter and connect the SpO$_2$ adapter to the MULTI socket on the unit.
3. Attach the probe to the patient.
4. Monitoring starts. Set necessary settings.

Selecting a Probe

Select the appropriate probe according to the purpose.

> **CAUTION**
>
> Only use Nihon Kohden specified electrodes, probes, transducers, thermistors and catheters. Otherwise, the maximum performance from the monitor cannot be guaranteed.

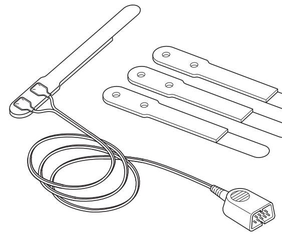
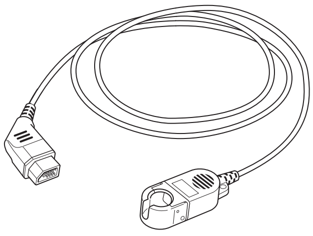
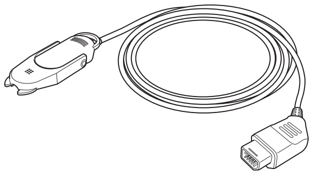
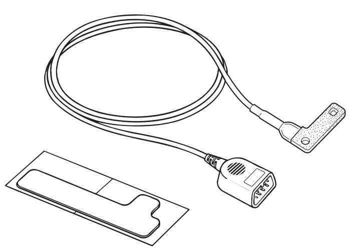
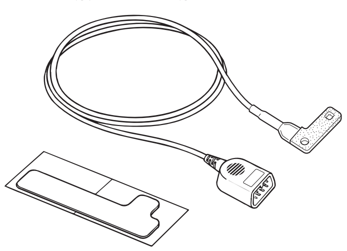
Nihon Kohden Reusable Probes

Model	Patient (Weight)	Attachment Site	SpO$_2$ Connection Cord/ SpO$_2$ Adapter
Finger Probe TL-201T 	Adults, children (Weight more than 20 kg)	Finger	SpO$_2$ Connection Cord JL-900P  SpO$_2$ Adapter JL-500P1/JL-500P2*  * JL-500P2 is not available for BSM-6000A series.
Multi-site Probe TL-220T 	Adults, infants (Weight 3 kg or more)	Finger or toe	
	Neonates (Weight 3 kg or less)	Instep and sole	
Finger Probe TL-630T3/TL-631T3 	Adults, children (TL-630T3: Weight more than 50 kg TL-631T3: Weight more than 20 kg)	Finger or toe	

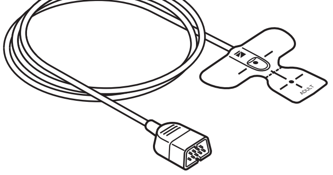
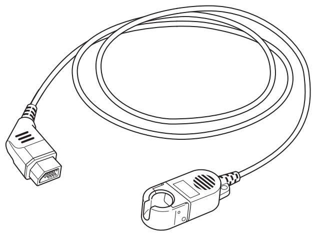
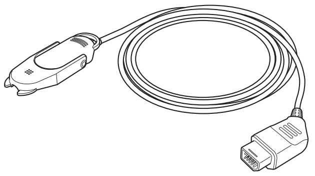
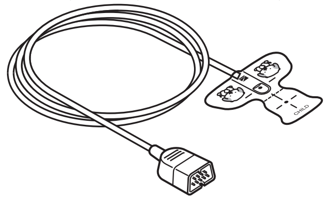
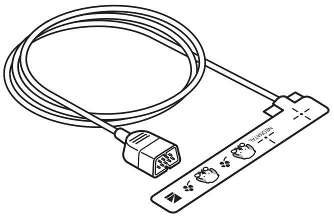
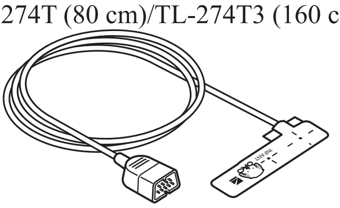
Nihon Kohden Disposable Probes

CAUTION

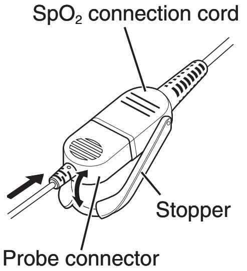
The disposable probe is not sterilized. Use the disposable probe only for a single patient. Never reuse the disposable probe for another patient because it causes cross infection.

Model	Patient (Weight)	Attachment Site	SpO_2 Connection Cord/ SpO_2 Adapter
TL-260T* 	Adults, children (Weight more than 3 kg)	Finger or toe	SpO_2 Connection Cord JL-900P  SpO_2 Adapter JL-500P1/JL-500P2* 
	Neonates (Weight less than 3 kg)	Instep and sole	
TL-051S/TL-052S  Cable length TL-051S: 80 cm TL-052S: 160 cm	Adults (Weight more than 50 kg)	Finger	
	Neonates (Weight less than 3 kg)	Instep and sole	
TL-061S/TL-062S  Cable length TL-061S: 80 cm TL-062S: 160 cm	Adults, children (Weight from 15 to 50 kg)	Finger	
	Children, infants (Weight from 3 to 15 kg)	Toe	

* TL-260T multi-site Y probe and JL-500P2 SpO_2 adapter are not available for BSM-6000A series.

Model	Patient	Attachment Site	SpO$_2$ Connection Cord/ SpO$_2$ Adapter
TL-271T (80 cm)/TL-271T3 (160 cm) 	Adult (Weight more than 30 kg)	Finger or toe	SpO$_2$ Connection Cord JL-900P  SpO$_2$ Adapter JL-500P1/JL-500P2*  * JL-500P2 SpO$_2$ adapter is not available for BSM-6000A series.
TL-272T (80 cm)/TL-272T3 (160 cm) 	Child (Weight from 10 to 50 kg)		
TL-273T (80 cm)/TL-273T3 (160 cm) 	Neonate (Weight less than 3 kg)	Instep and sole	
	Adult (Weight more than 40 kg)	Finger or toe	
TL-274T (80 cm)/TL-274T3 (160 cm) 	Infant (Weight from 3 to 20 kg)		

Connecting Cables and Attaching the Probes



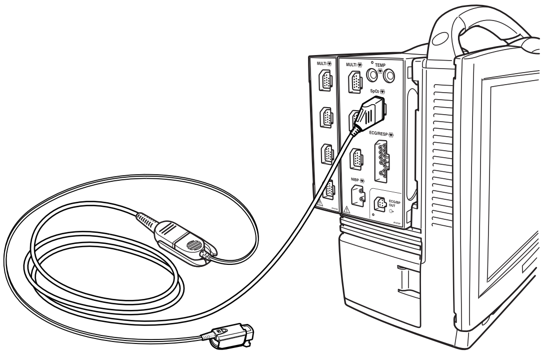
Connecting Cable to the Unit

SpO$_2$ measurement at one site

1. Open the stopper of the SpO$_2$ connection cord and connect the probe connector firmly.

2. Close the stopper.

3. Connect the SpO$_2$ connection cord to the SpO$_2$ socket on the unit.

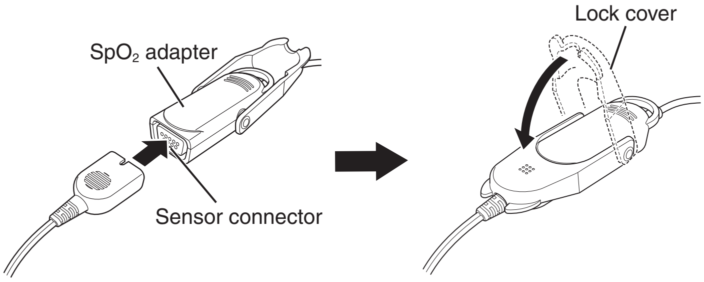


When connecting the TL-201T finger probe

SpO_2 measurement at two sites

1. Connect the probe to the SpO_2 connection cord and connect the SpO_2 connection cord to the SpO_2 socket on the unit.

2. Connect another SpO_2 probe to the sensor connector on the SpO_2 adapter.

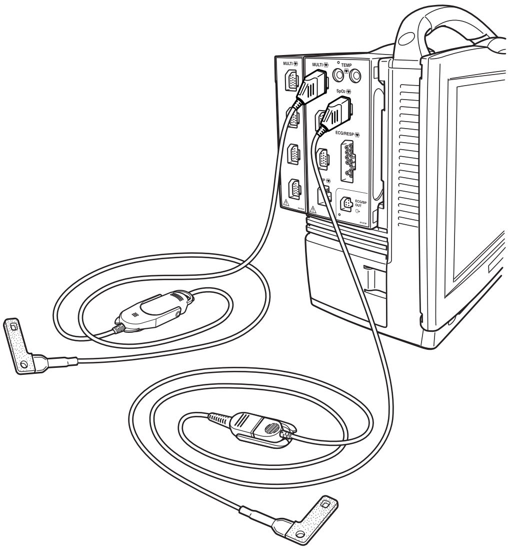


3. Close the lock cover.

4. Connect the SpO_2 adapter to the MULTI socket on the unit.

NOTE

The MULTI socket on the AY-660P input unit cannot be used.



When connecting the TL-051S/TL-052S probe

Attaching the Probe to the Patient

Refer to the probe manual.

Monitoring SpO_2

When the preparation is done properly, the SpO_2 value and pulse waveform appear on the screen.

The SpO_2 value acquired from the SpO_2 probe connected to the SpO_2 socket is displayed as "SpO_2" value and the SpO_2 value acquired from the SpO_2 probe connected to the MULTI socket is displayed as "SpO_2-2" value on the screen.

CAUTION

When the probe is attached on an appropriate site with sufficient circulation and an error message about probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.

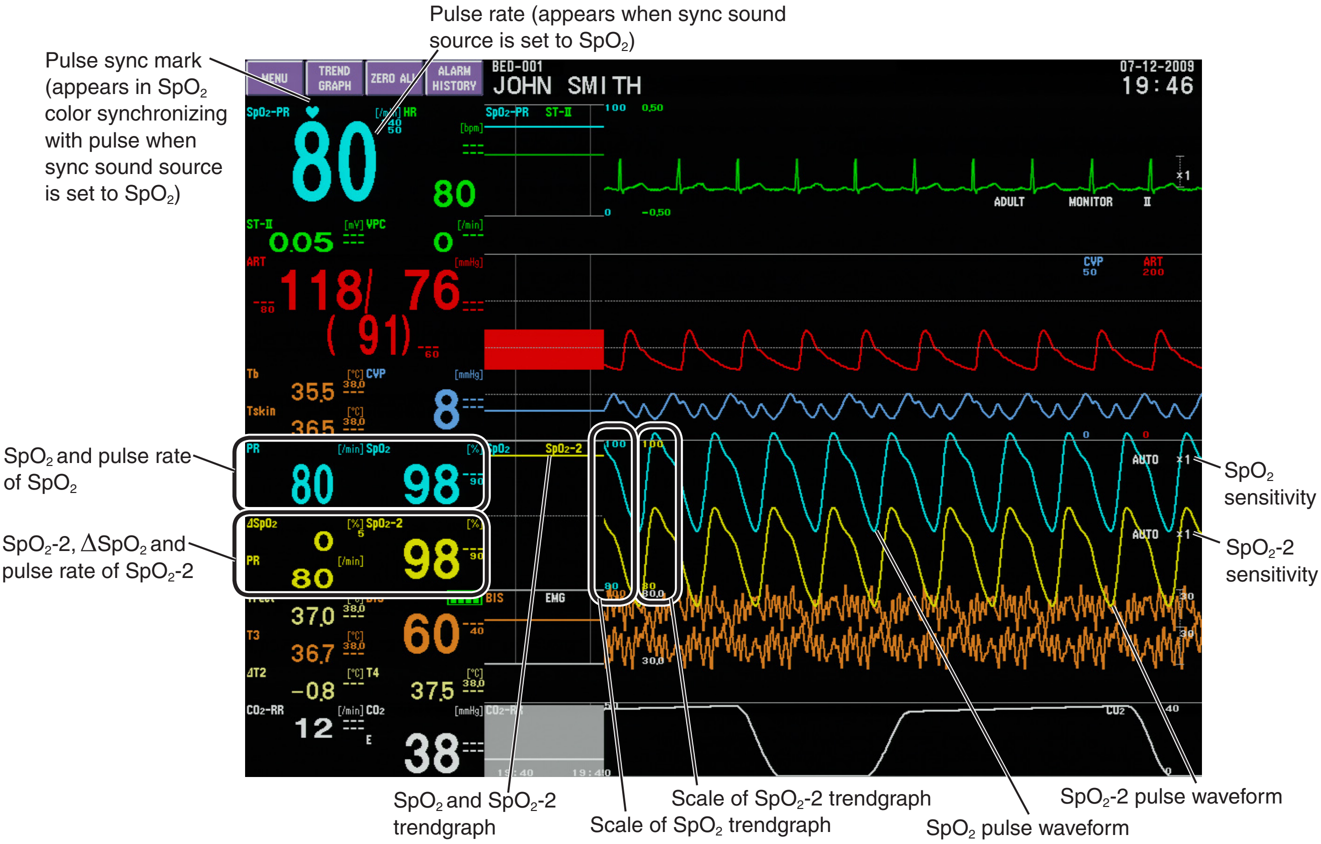
CAUTION

When a message indicates a faulty probe or faulty SpO_2 connection cord, stop monitoring and replace the probe or SpO_2 connection cord with a new one.

NOTE

In order to maintain sufficient blood circulation, keep the measurement site warm by covering with a blanket or something similar. Warming the site is effective, especially for a patient with a small pulse amplitude.

SpO_2 Information on the Home Screen


Pulse rate (appears when sync sound source is set to SpO_2)
Pulse sync mark (appears in SpO_2 color synchronizing with pulse when sync sound source is set to SpO_2)
SpO_2 and pulse rate of SpO_2
SpO_2-2, ΔSpO_2 and pulse rate of SpO_2-2
SpO_2 sensitivity
SpO_2-2 sensitivity
SpO_2 and SpO_2-2 trendgraph
Scale of SpO_2-2 trendgraph
Scale of SpO_2 trendgraph
SpO_2-2 pulse waveform
SpO_2 pulse waveform
MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
07-12-2009
19:46
SpO2-PR
80
HR
80
ST-II
0.05
VPC
0
ART
118/ 76
(91)
Tb
35.5
Tskin
36.5
CVP
8
PR
80
SpO2
98
ΔSpO2
0
SpO2-2
98
PR
80
37.0
T3
36.7
BIS
60
ΔT2
-0.8
T4
37.5
CO2-RR
12
CO2
38
ADULT
MONITOR
II
AUTO ×1
AUTO ×1
EMG

Changing SpO_2 Settings

Change settings on the SpO_2 window. The following settings can be changed for SpO_2 monitoring.

The following settings can be changed on the SpO_2 tab.

- Pulse waveform sensitivity
- SpO_2 and pulse rate alarm limits
- Display pulse rate in SpO_2 numeric data area on the home screen

The following settings can be changed on the SpO_2-2 tab for dual SpO_2 monitoring.

- Pulse waveform sensitivity
- SpO_2-2 and ΔSpO_2 alarm limits
- Display pulse rate and ΔSpO_2 in SpO_2-2 numeric data area on the home screen

The following settings are common settings for SpO_2 and SpO_2-2 tabs.

- Sync source
- Sync sound pitch
- Pulse rate display on or off
- Response mode
- Sensitivity mode (when using BSM-6000 series software version 03-01 or later, AY-600P series input unit software version 03-01 or later, AY-600P series input unit SpO_2 module version 01-11 or later and JL-500P1/P2 version 01-11 or later. The version can be confirmed on the INFO page of the SYSTEM SETUP window.)

When monitoring dual SpO_2, display the SpO_2-2 page of the SpO_2 window to change the SpO_2-2 settings.

The SpO_2 and SpO_2 -2 pulse waveform sweep speed and SpO_2 and SpO_2 -2 waveform display on the home screen can be selected on the DISPLAY window. Refer to Section 3 of the User’s Guide Part I.

SpO_2 data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

The scale of the SpO_2 trendgraph on the home screen is the same scale as the trendgraph of the Review window. Refer to Operator’s Manual or Section 6 of the User’s Guide Part I.

The SpO_2-2 page is only displayed when the JL-500P1 or JL-500P2* SpO_2 adapter is connected to the MULTI socket on the input unit.
* JL-500P2 SpO_2 adapter is not available for BSM-6000A series.

Changing the Sensitivity

The sensitivity determines the size of the pulse waveform on both the screen and recording paper.

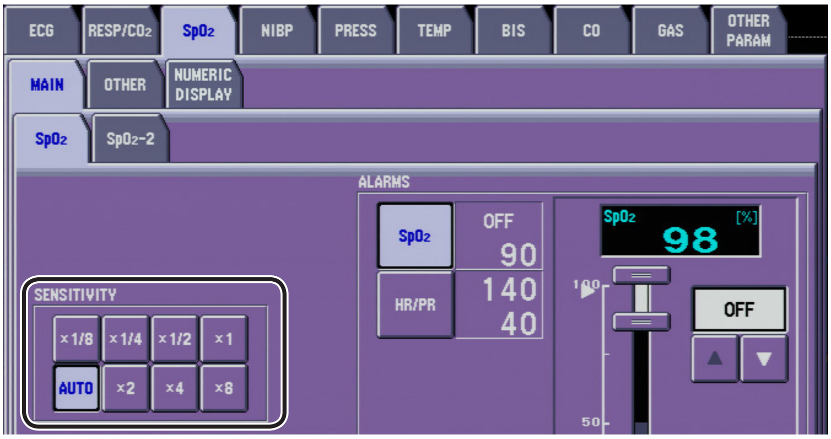
The sensitivity can be set manually or automatically. When you select auto sensitivity, the sensitivity is automatically determined according to the present SpO_2 pulse waveform. When sensitivity is set automatically, “AUTO” appears beside the sensitivity on the screen.

NOTE

The pulse wave amplitude varies according to the ratio of the pulsation component to the entire transmitted IR signal. When the pulsation component ratio is 1%, the pulse wave amplitude is about 10 mm at ×1 sensitivity on the display.

1. SpO_2: Display the SpO_2 tab of the SpO_2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2 tab.
   SpO_2-2: Display the SpO_2-2 tab of the SpO_2-2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2-2 tab.

2. Select the sensitivity from ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO in the <SENSITIVITY> box.



3. Press the [Home] key to return to the home screen.

Changing the SpO_2 and Pulse Rate Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

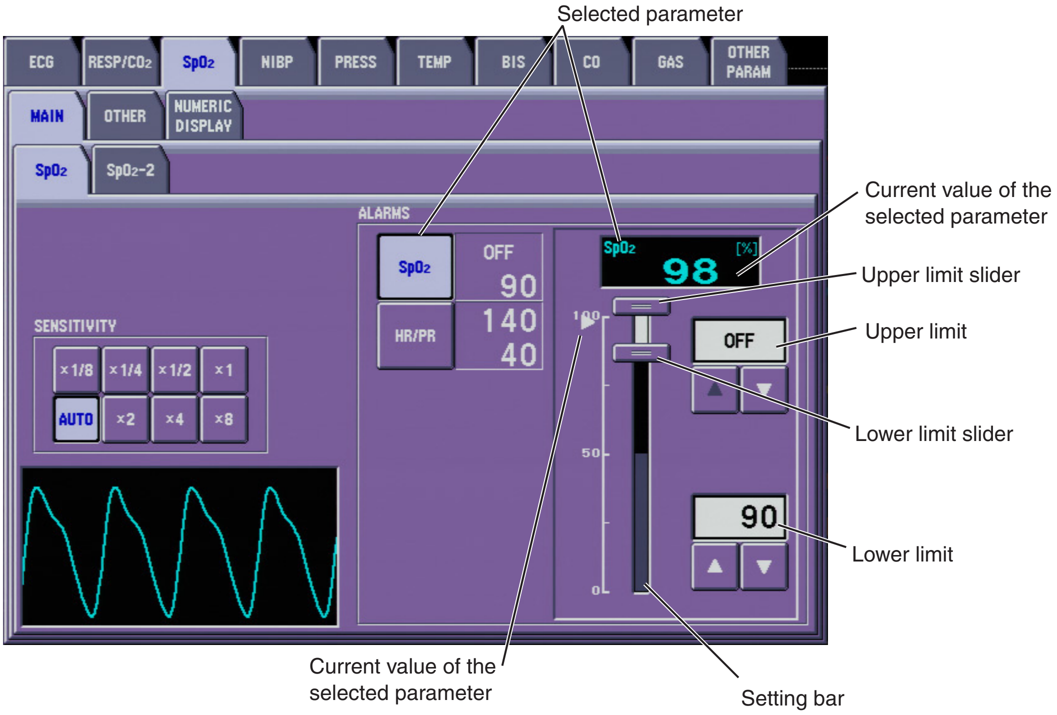
You can set the upper and lower SpO_2, SpO_2-2, heart rate/pulse rate alarm limits and ΔSpO_2 on the SpO_2 window. You can set all alarms including the upper and lower SpO_2, SpO_2-2, heart rate/pulse rate alarm limits and ΔSpO_2 on the ALARM LIMITS window (See Operator’s Manual or Section 5 of the User’s Guide Part I). The heart rate/pulse rate alarm limits can also be changed on the ECG and PRESS window.

Setting Range

SpO_2 upper limit:	51 to 100%SpO_2 in 1%SpO_2 steps, OFF (default setting: OR/ICU-OFF, NICU-95)
SpO_2 lower limit:	OFF, 50 to 99%SpO_2 in 1%SpO_2 steps (default setting: OR/ICU-90, NICU-85)
SpO_2-2 upper limit:	51 to 100%SpO_2 in 1%SpO_2 steps, OFF (default setting: OR/ICU-OFF, NICU-95)
SpO_2-2 lower limit:	OFF, 50 to 99%SpO_2 in 1%SpO_2 steps (default setting: OR/ICU-90, NICU-85)
ΔSpO_2 upper limit:	OFF, 1 to 50%SpO_2 in 1%SpO_2 steps (default setting: 5)
HR/PR upper limit:	When <SYNC SOURCE> is set to ECG: 16 to 300 beats/min in 1 beat/min steps, OFF When <SYNC SOURCE> is set to PRESS or SpO_2: 31 to 300 beats/min in 1 beat/min steps, OFF (default setting: OR/ICU-140, NICU-200)
HR/PR lower limit:	When <SYNC SOURCE> is set to ECG: OFF, 15 to 299 beats/min in 1 beat/min steps When <SYNC SOURCE> is set to PRESS or SpO_2: OFF, 30 to 299 beats/min in 1 beat/min steps (default setting: OR/ICU-50, NICU-100)

1. SpO_2: Display the SpO_2 tab of the SpO_2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2 tab.
   SpO_2-2: Display the SpO_2-2 tab of the SpO_2-2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2-2 tab.

2. Touch the SpO_2 key to change the SpO_2 alarm setting.
   Touch the HR/PR key to change the heart rate/pulse rate alarm setting.
   Touch the SpO_2-2 key on the SpO_2-2 tab to change the SpO_2-2 alarm setting.
   Touch the ΔSpO_2 key on the SpO_2-2 tab to change the ΔSpO_2 alarm setting.


Selected parameter
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO2
SpO2-2
ALARMS
SpO2
OFF
90
HR/PR
140
40
SpO2 [%]
98
100
50
0
OFF
90
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8
Current value of the selected parameter
Upper limit slider
Upper limit
Lower limit slider
Lower limit
Current value of the selected parameter
Setting bar

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Changing the Sync Sound Source

You can select ECG, SpO_2 pulse (SpO_2) or arterial blood pressure pulse (PRESS) as the sync source. When the arterial blood pressure pulse is selected, the blood pressure of the highest priority label is used. The sync source can also be changed on the ECG and PRESS windows.

When pulse wave and pressure waveform are irregular because of an IABP, select ECG.

NOTE

- When heart rate is unstable because of an ESU, select SpO_2 or PRESS.
- When the connection cord of SpO_2 or IBP of the arterial blood pressure is disconnected from the monitor and an alarm occurs when the sync source is set to SpO_2 or PRESS, the sync source changes to ECG when the alarm is silenced by pressing the [Silence Alarms] key. The sync source returns to SpO_2 or PRESS when the SpO_2 or IBP is monitored again. When using PRESS as the sync source, adjust zero balance.
- When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO_2 or PRESS, the sync source does not change to ECG when the alarm is silenced, and "- - -" is displayed for PR.
- The SpO_2-2 cannot be set to the sync sound source.

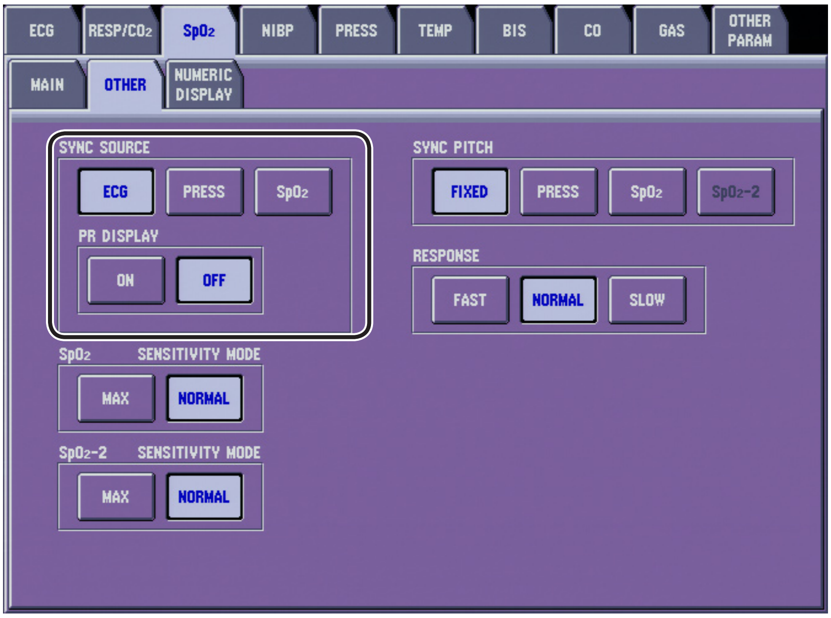
When the sync source is set to ECG and ECG is not measured, there is no sync sound.

When SpO_2 or PRESS is selected, the pulse rate can be displayed to the left of the heart rate on the screen and the sync mark synchronizes with the pulse.

1. Display the OTHER page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → OTHER tab.

2. Select the sync source in the <SYNC SOURCE> box.
   ECG: QRS
   PRESS: Pulse wave of the highest priority arterial blood pressure
   SpO_2: SpO_2 pulse

To display the pulse rate to the left of the heart rate on the home screen, select ON for <PR DISPLAY>. This setting is only available when <SYNC SOURCE> is set to ECG.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
SpO2 SENSITIVITY MODE
MAX
NORMAL
SpO2-2 SENSITIVITY MODE
MAX
NORMAL
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
RESPONSE
FAST
NORMAL
SLOW

3. Press the [Home] key to return to the home screen.

Selecting Sync Sound Pitch

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set on the SYSTEM SETUP window (see Section 3 of the Administrator's Guide). When you select variable pitch, the pitch of the sync sound changes according to SpO_2 value or systolic BP value of the arterial blood pressure so that you can recognize the change on the patient from the pitch of the sync sound without looking at the monitor. The sync pitch can also be changed on the ECG and PRESS windows.

When using AY-660P, AY-661P, AY-663P, AY-671P or AY-673P input unit, the sync sound pitch can be set to change according to the SpO_2 value of the SpO_2-2 when monitoring dual SpO_2. (AY-660P, AY-661P or AY-663P input units are not available for BSM-6000A series.)

When the sync sound source is set to SpO_2 and the SpO_2 value is below 81%SpO_2, the low pitch is automatically selected.

When the sync sound source is set to SpO_2 and the “CHECK PROBE” or “DETECTING PULSE” message is displayed on the screen, the sync sound stops.

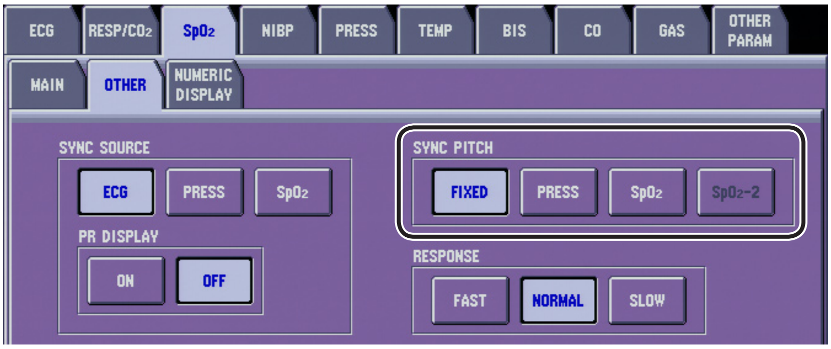
When the sync sound source is set to ECG or PRESS, the sync pitch is set to SpO_2 and the SpO_2 cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO$_2$ the sync pitch is set to PRESS and the IBP cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO$_2$ and the IBP connection cord is disconnected, the low pitch is automatically selected. After connecting the IBP connection cord, adjust zero balance.

1. Display the OTHER page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → OTHER tab.

2. Select the sync sound pitch from the <SYNC PITCH> box.
   FIXED: The pitch is fixed to the pitch selected on the SYSTEM SETUP window.
   PRESS: The pitch is high when the BP value is above 120 mmHg. The pitch is low when the BP value is below 20 mmHg. The pitch changes from high to low in 20 steps for each 5 mmHg change between 120 and 20 mmHg BP value. The BP value of the highest priority arterial blood pressure is used.
   SpO$_2$ and SpO$_2$-2: The pitch changes in 20 steps from high to low for each 1%SpO$_2$ change in SpO$_2$ value between 100%SpO$_2$ and 81%SpO$_2$. SpO$_2$-2 is only available when using AY-661P, AY-663P, AY-671P or AY-673P input unit.



3. Press the [Home] key to return to the home screen.

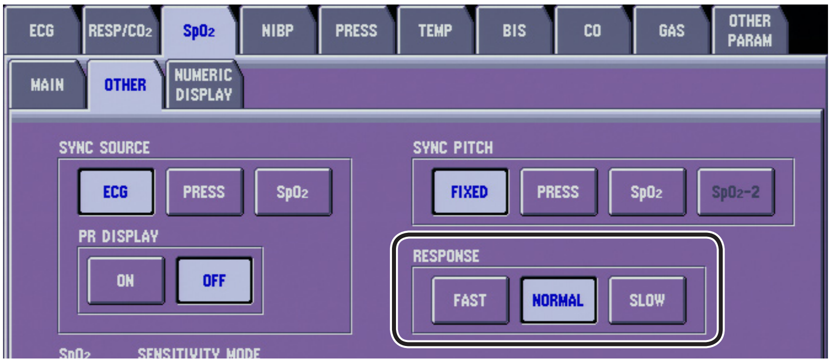
Selecting the Response Mode

There are three response modes. Each response mode uses a different time to enable accurate measurement according to patient conditions. When measurement condition is unstable, response becomes slower in all modes. For details on the response time, refer to “Specifications - SpO$_2$” in Operator’s Manual.

FAST: Select this for special applications that require a fast response. “FAST” is suitable for detecting short apnea.
NORMAL: For normal monitoring.
SLOW: Select this when you need to suppress a rapid change in SpO$_2$.

1. Display the OTHER page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → OTHER tab.

2. Select the mode in the <RESPONSE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PR DISPLAY
ON
OFF
RESPONSE
FAST
NORMAL
SLOW
SpO2 SENSITIVITY MODE

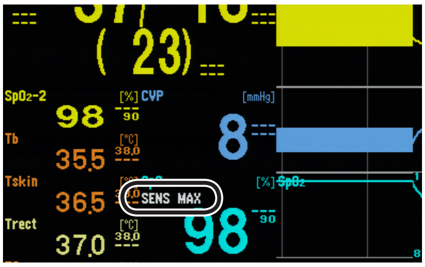
3. Press the [Home] key to return to the home screen.

Selecting SpO_2 Sensitivity Mode

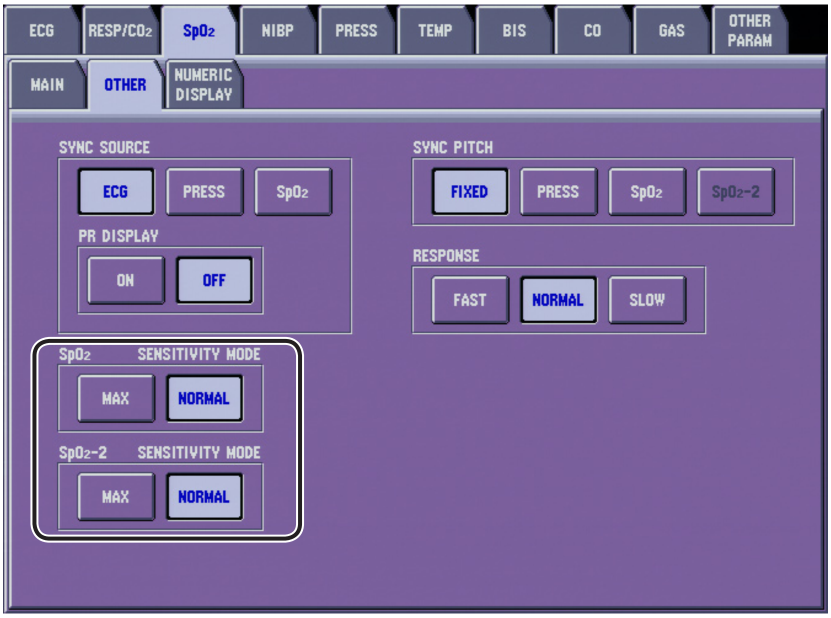
This setting is only available when using BSM-6000 series software version 03-01 or later, AY-600P series input unit software version 03-01 or later, AY-600P series input unit SpO_2 module version 01-11 or later and JL-500P1/P2 version 01-11 or later.

Select the sensitivity mode for SpO_2 monitoring.

1. Display the OTHER page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → OTHER tab.


(23)
SpO2-2
98
90
[%] CVP
[mmHg]
8
Tb
35.5
38.0
Tskin
36.5
SENS MAX
[%] SpO2
Trect
37.0
38.0
98
90

2. Select the sensitivity mode in the <SpO_2 SENSITIVITY MODE> and/or <SpO_2-2 SENSITIVITY MODE> box.
   For normal monitoring, select “NORMAL”.
   Select “MAX” when it is difficult to detect pulse, such as when monitoring a patient with peripheral circulation insufficiency or when an IABP is used.
   When “MAX” is selected, “SENS MAX” appears in the SpO_2 value area on the home screen.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PR DISPLAY
ON
OFF
RESPONSE
FAST
NORMAL
SLOW
SpO2 SENSITIVITY MODE
MAX
NORMAL
SpO2-2 SENSITIVITY MODE
MAX
NORMAL

NOTE

When "MAX" is selected, a waveform and numeric value for SpO$_2$ may appear even when the probe is detached from the patient. When not monitoring SpO$_2$, disconnect the SpO$_2$ connection cord from the unit.

3. Press the [Home] key to return to the home screen.

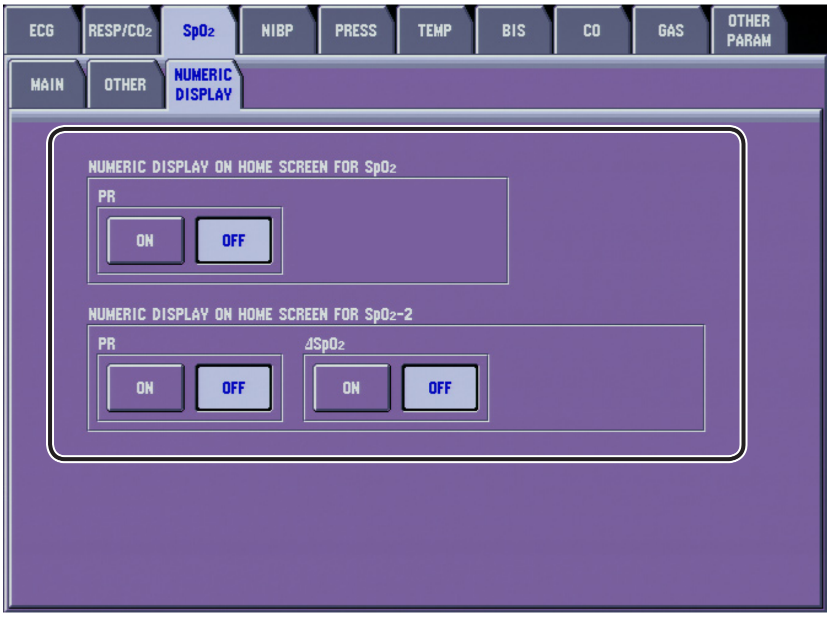
WARNING

When not monitoring SpO$_2$, disconnect the SpO$_2$ connection cord from the input unit. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.

Displaying Pulse Rate and ΔSpO$_2$ on the Home Screen

The pulse rate display in SpO$_2$ and SpO$_2$-2 area and the ΔSpO$_2$ display in SpO$_2$-2 area on the home screen can be set to on or off.

1. Display the NUMERIC DISPLAY page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → NUMERIC DISPLAY tab.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
NUMERIC DISPLAY ON HOME SCREEN FOR SpO2
PR
ON
OFF
NUMERIC DISPLAY ON HOME SCREEN FOR SpO2-2
PR
ON
OFF
ΔSpO2
ON
OFF

2. Select ON or OFF for each parameter in the <NUMERIC DISPLAY ON HOME SCREEN FOR SpO$_2$> and/or <NUMERIC DISPLAY ON HOME SCREEN FOR SpO$_2$-2> box.

3. Press the [Home] key to return to the home screen.

Section 4-2 SpO$_2$ Monitoring on AY-651P/653P Input Unit

General 4.2.2
        Silencing SpO$_2$ Alarm 4.2.4
        When Monitoring Dual SpO$_2$ 4.2.4
Preparing for SpO$_2$ Monitoring 4.2.6
    Preparation Flowchart 4.2.6
    Selecting a Probe 4.2.6
        Nellcor SpO$_2$ Probes 4.2.6
    Connecting Cables and Attaching the Probes 4.2.7
        Connecting Cable to the Unit 4.2.7
        SpO$_2$ Measurement at Two Sites 4.2.8
        Attaching the Probe to the Patient 4.2.8
Monitoring SpO$_2$ 4.2.9
    SpO$_2$ Information on the Home Screen 4.2.9
Changing SpO$_2$ Settings 4.2.10
    Changing the Sensitivity 4.2.10
    Changing the SpO$_2$ and Pulse Rate Alarm Limits 4.2.11
    Changing the Sync Sound Source 4.2.13
    Selecting Sync Sound Pitch 4.2.14
    Displaying Pulse Rate and ΔSpO$_2$ on the Home Screen 4.2.15

General

Monitoring SpO_2 with Nellcor probes requires an AY-651P or AY-653P input unit or IF-919P communication cable.

To monitor SpO_2 using an AY-651P or AY-653P input unit, attach a probe to the patient and connect it to the SpO_2 socket on the AY-651P or AY-653P input unit.

To monitor SpO_2 using an IF-919P communication cable, attach a probe to the patient and connect it to the OxiMax™ N-600x™ pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor with the IF-919P communication cable.

Dual SpO_2 Monitoring

To monitor dual SpO_2 using an AY-651P or AY-653P input unit, connect a Nellcor probe to the SpO_2 socket on the AY-651P or AY-653P input unit, another probe to the OxiMax™ N-600x™ pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-919P communication cable.

To monitor dual SpO_2 using an IF-919P communication cable, two OxiMax™ N-600x™ pulse oximeters and two IF-919P communication cables are required. Connect a Nellcor probe to the OxiMax™ N-600x™ pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-919P communication cable.

WARNING

SpO_2 measurement may be incorrect in the following cases.

- When the patient's carboxyhemoglobin or methemoglobin increases abnormally.
- When dye is injected in the blood.
- When using an electrosurgical unit.
- During CPR.
- When measuring at a site with venous pulse.
- When there is body movement.
- When the pulse wave is small (insufficient peripheral circulation).

WARNING

Check the circulation condition by observing the skin color at the measurement site and pulse waveform. Change the measurement site every 8 hours for disposable probes and every 4 hours for reusable probes. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.

- Patient with a fever
- Patient with peripheral circulation insufficiency
- Neonate or low birth weight infant with delicate skin

WARNING

When monitoring SpO_2 of a patient who is receiving photodynamic therapy, the light from the finger probe sensor may cause a burn. Photodynamic therapy uses a photosensitizing agent that has a side effect of photosensitivity.

WARNING

When not monitoring SpO_2, disconnect the SpO_2 connection cord from the input unit. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.

WARNING

To avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.

CAUTION

Only use the specified probes. Otherwise, SpO_2 cannot be monitored.

CAUTION

Normal external light does not affect monitoring but strong light such as a surgical light or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.

CAUTION

Turn off the power of mobile phones, small wireless devices and other devices which produce strong electromagnetic interference around a patient (except for devices allowed by the hospital administrator). Radio waves from devices such as mobile phones or small wireless devices may be mistaken as pulse waves and the displayed data may be incorrect.

CAUTION

While a patient is on medication which causes vasodilation, the pulse waveform may change and in rare cases the SpO_2 value might not be displayed.

NOTE

- Purchase of this instrument confers no express or implied license under any Nellcor Puritan Bennett patent to use this instrument with any oximetry sensor that is not manufactured or licensed by Nellcor Puritan Bennett.
- Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter. The SpO_2 measurement may be incorrect.

Silencing SpO_2 Alarm

This function is only available for BSM-6000A series. When the <SILENCE SpO_2 ALARM> on the ALARM window of the SYSTEM SETUP window is set to On, a second occurring SpO_2 alarm can be silenced when the [Silence Alarms] key is pressed. Refer to Section 3 of the Administrator’s Guide.

NOTE

When the <SILENCE SpO_2 ALARM> is set to On and the monitored SpO_2 value is close to the SpO_2 upper and lower alarm limit setting, you may have to press the [Silence Alarm] key several times to silence the SpO_2 alarm.

When Monitoring Dual SpO_2

CAUTION

When using the Nellcor OxiMaxTM N-600x™ pulse oximeter, the “Sensor Message” on the pulse oximeter do not function on the bedside monitor. When the SpO_2 data on the bedside monitor is abnormal, check the data on the pulse oximeter.

CAUTION

When two probes are attached too close to each other, the light from the probes interferes with each other and SpO_2 cannot be monitored properly. Make sure that there is no light interference when attaching two probes.

NOTE

- If a parameter is not monitored on the pulse oximeter, it is not displayed on the bedside monitor.
- Some parameters cannot be displayed on the bedside monitor even if they are monitored on the pulse oximeter.
- Waveforms from the pulse oximeter are not synchronized with the waveforms measured on the bedside monitor.

Dual SpO_2 Function (SpO_2 Measurement at Two Sites)

When there is a right → left shunt in a patent ductus arteriosus (PDA), there will be a difference in oxygen saturation between the right upper limb (pre-ductal) and lower limb (post-ductal).

By connecting two SpO_2 probes to the bedside monitor, SpO_2 can be monitored at the upper limb and lower limb, and the SpO_2 difference (ΔSpO_2) can be calculated. The ΔSpO_2 is calculated by subtracting the SpO_2 value from the probe connected to the MULTI socket (post-ductal) from the SpO_2 value from the probe connected to the SpO_2 socket (pre-ductal).

When there is a right → left shunt through the ductus arteriosus, the SpO_2 of the lower limb is lower than the SpO_2 of the right upper limb. Therefore, when the SpO_2 probe connected to the SpO_2 socket is attached to a right upper limb and the probe connected to the MULTI socket is attached to a lower limb, the ΔSpO_2 is indicated as a plus value.

PPHN (Persistent Pulmonary Hypertension of Newborn) and Dual SpO_2

PPHN (Persistent Pulmonary Hypertension of Newborn) is a critical disease where elevated pulmonary vascular resistance and serious pulmonary hypertension remain after birth and there is a large right → left shunt through the ductus arteriosus.

For PPHN from the right → left shunt in a patent ductus arteriosus (PDA), it is reported that monitoring the difference in SpO_2 between right upper limb (preductal) and lower limb (post-ductal) is useful to diagnose PPHN, decide the timing of starting/stopping treatment, and decide the operation schedule.

Preparing for SpO_2 Monitoring

Preparation Flowchart

1. Select the probe.

2. When using an AY-651P or AY-653P input unit, connect the probe to the SpO_2 connection cord and connect the SpO_2 connection cord to the SpO_2 socket on the unit.

   When using an IF-919P communication cable, connect the probe to the OxiMax™ N-600x™ pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-919P communication cable. For details, refer to the OxiMax™ N-600x™ pulse oximeter and IF-919P communication cable manuals.

   When monitoring dual SpO_2:
   Connect the probe to the OxiMax™ N-600x™ pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-919P communication cable. For details, refer to the OxiMax™ N-600x™ pulse oximeter and IF-919P communication cable manuals.

3. Attach the probe to the patient.

4. Monitoring starts. Set necessary settings.

Selecting a Probe

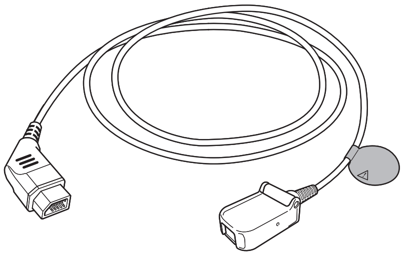
Select the appropriate probe according to the purpose.

CAUTION

Only use the OxiMAX™ series sensor probes on this monitor.

NOTE

When using Nellcor probes, read the instructions provided with the probe.



JL-650P SpO_2 connection cord

Nellcor SpO_2 Probes

For Nellcor probes, use OxiMax™ series sensor probes. To use Nellcor probes, the JL-650P SpO_2 connection cord (3.0 m) is required.

The Nellcor probes and cables are available direct from Nellcor Puritan Bennett or their suppliers.

The following Nellcor probes can be used with this bedside monitor.

OxiMax Adhesive Sensors: Single-page use

Description	Weight Range	Measuring Accuracy	Qty	Catalog #
MAX-FAST Adhesive Forehead Sensor	>10 kg	±2%SpO_2	Case of 24	MAXFAST
MAX-FAST Headband	—	—	Case of 12	10004954
MAX-A Adhesive Sensor, adult	>30 kg	±2%SpO_2	Case of 24	MAXA
MAX-AL Adhesive Sensor, adult (longer, 36 inch cable)	>30 kg	±2%SpO_2	Case of 24	MAXAL
MAX-N Adhesive Sensor, neonatal/adult	<3 kg or >40 kg	±2%SpO_2	Case of 24	MAXN
MAX-P Adhesive Sensor, pediatric	10 to 50 kg	±2%SpO_2	Case of 24	MAXP
MAX-I Adhesive Sensor, infant	3 to 20 kg	±2%SpO_2	Case of 24	MAXI
MAX-R Adhesive Sensor, adult nasal	>50 kg	±3.5%SpO_2	Case of 24	MAXR
MAX Sensor Assortment Pack (2 MAX-A and 2 MAX-N sensors)	—	±2%SpO_2	1	MAXPACI

OxiMax OxiCliq® Sensors: Reusable cable with adhesive sensor bandage

Description	Weight Range	Measuring Accuracy	Qty	Catalog #
OxiCliq Sensor Cable (3 ft)	—	—	1	OC-3
OxiCliq A, adult	>30 kg	±2.5%SpO_2	Case of 24	A
OxiCliq N, neonatal/adult	<3 kg or >40 kg	Neonate: ±3.5%SpO_2 Adult: ±2.5%SpO_2	Case of 24	N
OxiCliq P, pediatric	10 to 50 kg	±2.5%SpO_2	Case of 24	P
OxiCliq I, infant	3 to 20 kg	±2.5%SpO_2	Case of 24	I

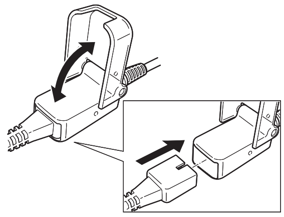
OxiMax Reusable Sensors

Description	Weight Range	Measuring Accuracy	Qty	Catalog #
Durasensor® DS-100A finger-clip sensor, adult	>40 kg	±3%SpO_2	1	DS100A
Oxiband® OXI-A/N adult/neonatal	<3 kg or >40 kg	Neonate: ±4%SpO_2 Adult: ±3%SpO_2	1	OXI-A/N
Oxiband OXI-P/I pediatric/infant	<3 kg or >40 kg	±3%SpO_2	1	OXI-P/I
Dura-Y® D-YS multisite sensor	>1 kg	Neonate: ±4%SpO_2 Infant/Adult: ±3%SpO_2	1	D-YS
D-YSE ear clip for Dura-Y sensor	>30 kg	±3.5%SpO_2	1	D-YSE
PediCheck™ D-YSPD pediatric spot-check sensor	<3 kg or >40 kg	±3.5%SpO_2	1	D-YSPD

Connecting Cables and Attaching the Probes

Connecting Cable to the Unit

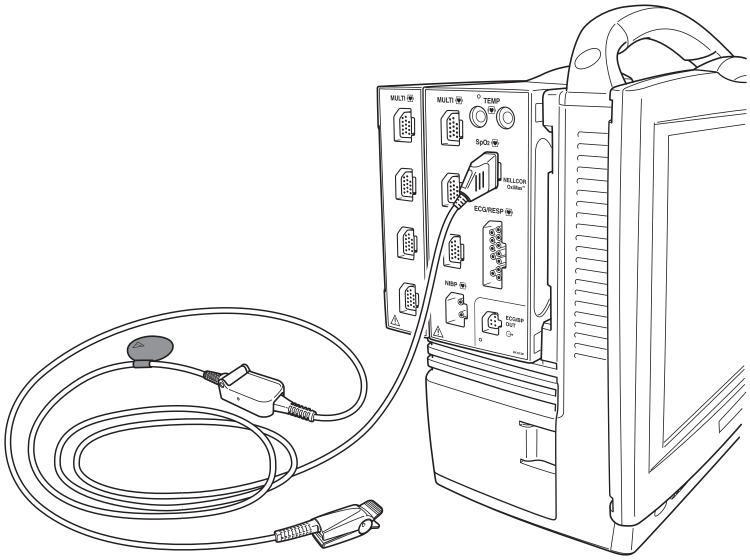
Using an AY-651P or AY-653P Input Unit



1. Open the stopper of the SpO_2 connection cord and connect the probe connector firmly.

2. Close the stopper. Check that it clicks and is firmly closed.

3. Connect the SpO$_2$ connection cord to the SpO$_2$ socket on the unit.



Using an IF-919P Communication Cable

1. Connect an SpO$_2$ probe to the OxiMax^{TM} N-600x^{TM} pulse oximeter. Refer to the pulse oximeter manual.

2. Connect the IF-919P communication cable to the pulse oximeter. Refer to the communication cable manual.

3. Connect the communication cable to the multi-link socket on the unit.

SpO$_2$ Measurement at Two Sites

Using an AY-651P or AY-653P Input Unit

1. Connect the probe to the SpO$_2$ connection cord and connect the SpO$_2$ connection cord to the SpO$_2$ socket on the input unit.

2. Connect another SpO$_2$ probe to the OxiMax^{TM} N-600x^{TM} pulse oximeter. Refer to the pulse oximeter manual.

3. Connect the IF-919P communication cable to the pulse oximeter. Refer to the communication cable manual.

4. Connect the communication cable to the multi-link socket on the unit.

Using an IF-919P Communication Cable

Uses two OxiMax^{TM} N-600x^{TM} pulse oximeters. Connect an SpO$_2$ probe to each OxiMax^{TM} N-600x^{TM} pulse oximeter and connect the pulse oximeters to the multi-link sockets on the unit with the IF-919P communication cables.

Attaching the Probe to the Patient

Refer to the probe manual.

Monitoring SpO_2

When the preparation is done properly, the SpO_2 value and pulse waveform appear on the screen.

The SpO_2 value acquired from the SpO_2 probe connected to the SpO_2 socket is displayed as "SpO_2" value and the SpO_2 value acquired from the SpO_2 probe connected to the pulse oximeter is displayed as "SpO_2-2" value on the screen.

CAUTION

When the probe is attached on an appropriate site with sufficient circulation and an error message about probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.

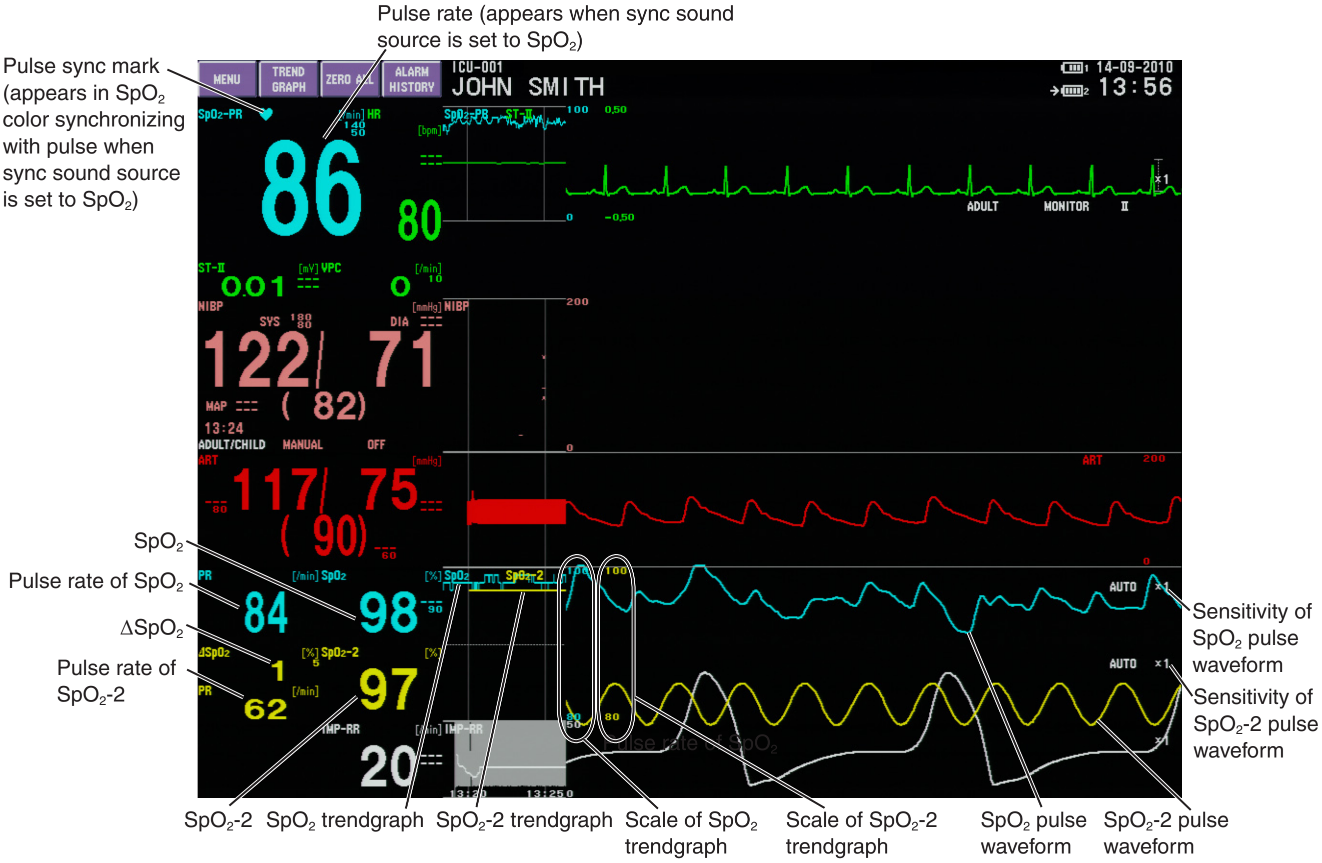
CAUTION

When a message indicates a faulty probe or faulty SpO_2 connection cord, stop monitoring and replace the probe or SpO_2 connection cord with a new one.

NOTE

In order to maintain sufficient blood circulation, keep the measurement site warm by covering with a blanket or something similar. Warming the site is effective, especially for a patient with a small pulse amplitude.

SpO_2 Information on the Home Screen


Pulse rate (appears when sync sound source is set to SpO2)
Pulse sync mark (appears in SpO2 color synchronizing with pulse when sync sound source is set to SpO2)
MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
14-09-2010
13:56
SpO2-PR
86
80
ST-II
0.01
VPC
0
NIBP
122/ 71
(82)
ADULT/CHILD
MANUAL
OFF
ART
117/ 75
(90)
ADULT
MONITOR
II
SpO2
Pulse rate of SpO2
ΔSpO2
Pulse rate of SpO2-2
PR
84
98
ΔSpO2
1
SpO2-2
62
97
IMP-RR
20
AUTO
x1
Sensitivity of SpO2 pulse waveform
Sensitivity of SpO2-2 pulse waveform
SpO2-2
SpO2 trendgraph
SpO2-2 trendgraph
Scale of SpO2 trendgraph
Scale of SpO2-2 trendgraph
SpO2 pulse waveform
SpO2-2 pulse waveform

Changing SpO_2 Settings

Change settings on the SpO_2 window. The following settings can be changed for SpO_2 monitoring.

The following settings can be changed on the SpO_2 tab.
- Pulse waveform sensitivity
- SpO_2 and pulse rate alarm limits*
- Display pulse rate in SpO_2 numeric data area on the home screen

* SpO_2 and pulse rate alarm limits cannot be changed on the bedside monitor for SpO_2 monitored by a Nellcor pulse oximeter.

The following settings can be changed on the SpO_2-2 tab for dual SpO_2 monitoring.
- Pulse waveform sensitivity
- ΔSpO_2 alarm limits
- Display SpO_2-2 pulse rate and/or ΔSpO_2 in SpO_2-2 numeric data area on the home screen

The following settings are common settings for SpO_2 and SpO_2-2 tabs. These settings are not available for SpO_2 monitored by a Nellcor pulse oximeter.
- Sync source
- Sync sound pitch

The SpO_2 data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

The scale of the SpO_2 trendgraph on the home screen is the same scale as the trendgraph of the Review window. Refer to Operator's Manual or Section 6 of the User's Guide Part I.

The SpO_2 pulse waveform sweep speed and the waveform display on the home screen can be selected on the DISPLAY window. Refer to Section 3 of the User's Guide Part I.

Changing the Sensitivity

The sensitivity determines the size of the pulse waveform on both the screen and recording paper.

The sensitivity can be set manually or automatically. When you select auto sensitivity, the sensitivity is automatically determined according to the present SpO_2 pulse waveform. When sensitivity is set automatically, "AUTO" appears beside the sensitivity on the screen.

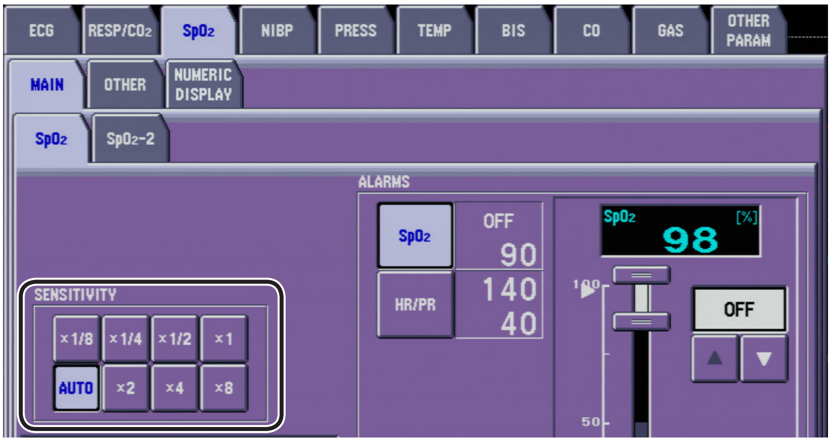
For the pulse waveform monitored by Nellcor pulse oximeter, the sensitivity cannot be set automatically.

NOTE

The pulse wave amplitude varies according to the ratio of the pulsation component to the entire transmitted IR signal. When the pulsation component ratio is 1%, the pulse wave amplitude is about 10 mm at ×1 sensitivity on the display.

1. SpO$_2$: Display the SpO$_2$ tab of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → MAIN tab → SpO$_2$ tab.
   SpO$_2$-2: Display the SpO$_2$-2 tab of the SpO$_2$-2 window.
   Press [Menu] key → SpO$_2$ key → MAIN tab → SpO$_2$-2 tab.

2. Select the sensitivity from ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO in the <SENSITIVITY> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO2
SpO2-2
ALARMS
SpO2
HR/PR
OFF
90
140
40
SpO2 [%]
98
100
50
OFF
▲
▼
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8

3. Press the [Home] key to return to the home screen.

Changing the SpO$_2$ and Pulse Rate Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

NOTE

When using a Nellcor pulse oximeter, SpO$_2$ and pulse rate alarm settings on the pulse oximeter are displayed on the SpO$_2$ window. Alarm settings can only be set on the pulse oximeter.

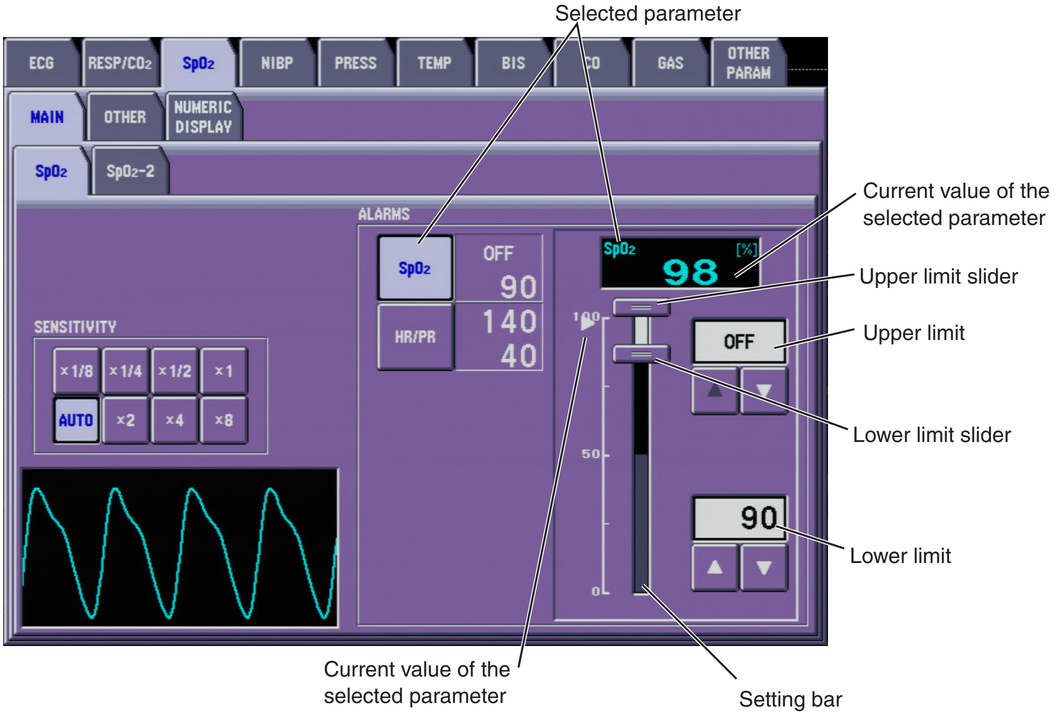
You can set the upper and lower SpO$_2$, heart rate/pulse rate and ΔSpO$_2$ alarm limits on the SpO$_2$ window. You can set all alarms, including the upper and lower SpO$_2$ and pulse rate alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I). The heart rate/pulse rate alarm limits can also be changed on the ECG and PRESS window.

Setting Range

SpO_2 upper limit:	51 to 100%SpO_2 in 1%SpO_2 steps, OFF (default setting: OFF)
SpO_2 lower limit:	OFF, 50 to 99%SpO_2 in 1%SpO_2 steps (default setting: 90)
HR/PR upper limit:	When <SYNC SOURCE> is set to ECG: 16 to 300 beats/min in 1 beat/min steps, OFF When <SYNC SOURCE> is set to PRESS or SpO_2: 31 to 300 beats/min in 1 beat/min steps, OFF (default setting: OR/ICU-140, NICU-200)
HR/PR lower limit:	When <SYNC SOURCE> is set to ECG: OFF, 15 to 299 beats/min in 1 beat/min steps When <SYNC SOURCE> is set to PRESS or SpO_2: OFF, 30 to 299 beats/min in 1 beat/min steps (default setting: OR/ICU-50, NICU-100)
ΔSpO_2 upper limit:	OFF, 1 to 50%SpO_2 in 1%SpO_2 steps (default setting: 5)

1. SpO_2: Display the SpO_2 tab of the SpO_2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2 tab.
   SpO_2-2: Display the SpO_2-2 tab of the SpO_2-2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2-2 tab.

2. Touch the SpO_2 key to change the SpO_2 alarm setting.
   Touch the HR/PR key to change the heart rate/pulse rate alarm setting.
   Touch the ΔSpO_2 key on the SpO_2-2 tab to change the ΔSpO_2 alarm setting.


Selected parameter
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO2
SpO2-2
ALARMS
SpO2
OFF
90
HR/PR
140
40
SpO2 [%] 98
100
50
0
OFF
90
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8
Current value of the selected parameter
Upper limit slider
Upper limit
Lower limit slider
Lower limit
Current value of the selected parameter
Setting bar

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Changing the Sync Sound Source

This setting is not available for SpO$_2$ monitored by a Nellcor pulse oximeter.

You can select ECG, SpO$_2$ pulse (SpO$_2$) or arterial blood pressure pulse (PRESS) as the sync source. When the arterial blood pressure pulse is selected, the blood pressure of the highest priority label is used. The sync source can also be changed on the ECG and PRESS windows.

When pulse wave and pressure waveform are irregular because of an IABP, select ECG.

NOTE

- When heart rate is unstable because of an ESU, select SpO$_2$ or PRESS.
- When the connection cord of SpO$_2$ or IBP of the arterial blood pressure is disconnected from the monitor and alarm occurs when the sync source is set to SpO$_2$ or PRESS, the sync source changes to ECG when the alarm is silenced by pressing the [Silence Alarms] key. The sync source returns to SpO$_2$ or PRESS when the SpO$_2$ or IBP is monitored again. When using PRESS as the sync source, adjust zero balance.
- When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO$_2$ or PRESS, the sync source does not change to ECG when the alarm is silenced and PR is displayed "- - -".

When the sync source is set to ECG and ECG is not measured, there is no sync sound.

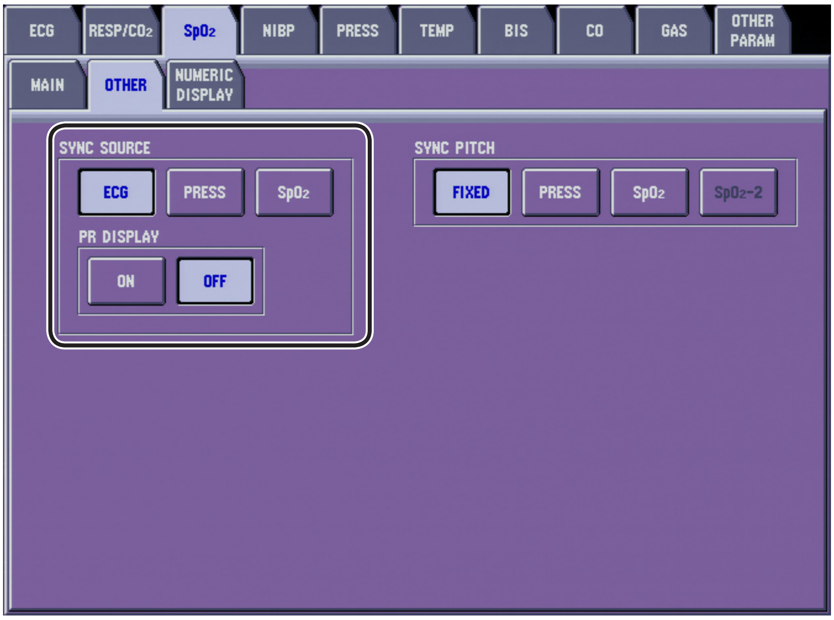
When SpO$_2$ or PRESS is selected, the pulse rate can be displayed to the left of the heart rate on the screen and the sync mark synchronizes with the pulse.

1. Display the OTHER page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → OTHER tab.

2. Select the sync source in the <SYNC SOURCE> box.

ECG:	QRS
PRESS:	Pulse wave of the highest priority arterial blood pressure
SpO$_2$:	SpO$_2$ pulse

   To display the pulse rate to the left of the heart rate on the home screen, select ON for <PR DISPLAY>. This setting is only available when <SYNC SOURCE> is set to ECG.



3. Press the [Home] key to return to the home screen.

Selecting Sync Sound Pitch

This setting is not available for SpO_2 monitored by a Nellcor pulse oximeter.

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set on the SYSTEM SETUP window (see Section 3 of the Administrator’s Guide). When you select variable pitch, the pitch of the sync sound changes according to SpO_2 value or systolic BP value of the arterial blood pressure so that you can recognize the change on the patient from the pitch of the sync sound without looking at the monitor. The sync pitch can also be changed on the ECG and PRESS windows. When the sync sound source is set to SpO_2 and the SpO_2 value is below 81%SpO_2, the low pitch is automatically selected.

When the sync sound source is set to SpO_2 and the “CHECK PROBE” or “DETECTING PULSE” message is displayed on the screen, the sync sound stops.

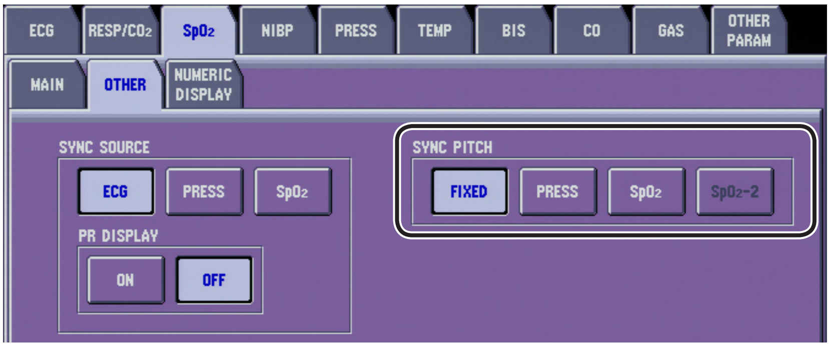
When the sync sound source is set to ECG or PRESS, the sync pitch is set to SpO_2 and the SpO_2 cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2, the sync pitch is set to PRESS and the IBP cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2 and the IBP connection cord is disconnected, the low pitch is automatically selected. After connecting the IBP connection cord, adjust zero balance.

1. Display the OTHER page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → OTHER tab.

2. Select the sync sound pitch from the <SYNC PITCH> box.
   FIXED: The pitch is fixed to the pitch selected on the SYSTEM SETUP window.
   PRESS: The pitch is high when the BP value is above 120 mmHg. The pitch is low when the BP value is below 20 mmHg. The pitch changes from high to low in 20 steps for each 5 mmHg change between 120 and 20 mmHg BP value. The BP value of the highest priority arterial blood pressure is used.
   SpO_2: The pitch changes in 20 steps from high to low for each 1%SpO_2 change in SpO_2 value between 100%SpO_2 and 81%SpO_2.

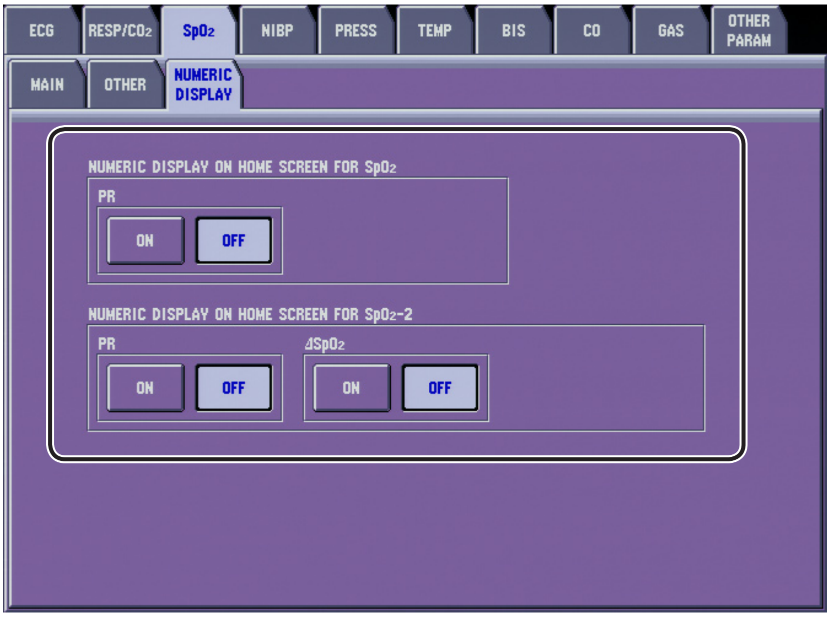

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2

3. Press the [Home] key to return to the home screen.

Displaying Pulse Rate and ΔSpO_2 on the Home Screen

The pulse rate display in SpO_2 and SpO_2-2 area and the ΔSpO_2 display in SpO_2-2 area on the home screen can be set to on or off.

1. Display the NUMERIC DISPLAY page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → NUMERIC DISPLAY tab.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
NUMERIC DISPLAY ON HOME SCREEN FOR SpO2
PR
ON
OFF
NUMERIC DISPLAY ON HOME SCREEN FOR SpO2-2
PR
ON
OFF
ΔSpO2
ON
OFF

2. Select ON or OFF for each parameter in the <NUMERIC DISPLAY ON

HOME SCREEN FOR SpO_2> and/or <NUMERIC DISPLAY ON HOME SCREEN FOR SpO_2-2> box.

3. Press the [Home] key to return to the home screen.

Section 4-3 SpO_2 Monitoring on AY-631P/633P Input Unit

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    When Monitoring Dual SpO_2 .... 4.3.4
Preparing for SpO_2 Monitoring 4.3.6
  Preparation Flowchart 4.3.6
  Selecting a Probe and Patient Cable 4.3.6
    Masimo SpO_2 Probes 4.3.7
    SpO_2 Connection Cords 4.3.8
  Connecting Cables and Attaching the Probes 4.3.8
    Connecting Cable to the Unit 4.3.8
    SpO_2 Measurement at Two Sites 4.3.9
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    Signal IQ 4.3.11
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  Changing the Sensitivity 4.3.14
  Changing the SpO_2 and Pulse Rate Alarm Limits 4.3.14
  Changing the Sync Sound Source 4.3.16
  Selecting Sync Sound Pitch 4.3.17
  Selecting the Averaging Time 4.3.19
  Selecting the Sensitivity Mode 4.3.19
  Turning FAST SAT Mode On or Off 4.3.20
  Displaying Pulse Rate, ΔSpO_2 and Perfusion Index (PI) on the Home Screen 4.3.21

General

Monitoring SpO_2 with Masimo probes requires an AY-631P or AY-633P input unit or IF-925P communication cable.

To monitor SpO_2 using an AY-631P or AY-633P input unit, attach a probe to the patient and connect it to the SpO_2 socket on the input unit.

To monitor SpO_2 using an IF-925P communication cable, attach a probe to the patient and connect it to the Radical™, Radical-7™ or Rad-8™ Masimo pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside montior with the IF-925P communication cable.

Dual SpO_2 Monitoring

To monitor dual SpO_2 using an AY-631P or AY-633P input unit, connect a Masimo probe to the SpO_2 socket on the AY-631P or AY-633P input unit, another probe to the Radical™, Radical-7™ or Rad-8™ Masimo pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-925P communication cable.

To monitor dual SpO_2, two Masimo pulse oximeters Radical™, Radical-7™ or Rad-8™, and two IF-925P communication cables are required. Connect a Masimo probe to the Masimo pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-925P communication cable.

WARNING

SpO_2 measurement may be incorrect in the following cases.

- When the patient’s carboxyhemoglobin or methemoglobin increases abnormally.
- When dye is injected in the blood.
- When using an electrosurgical unit.
- During CPR.
- When measuring at a site with venous pulse.
- When there is body movement.
- When the pulse wave is small (insufficient peripheral circulation).

WARNING

Check the circulation condition by observing the skin color at the measurement site and pulse waveform. Change the measurement site every 8 hours for disposable probes and every 4 hours for reusable probes. When using the probe on the following patients, take extreme care and change the measurement site more frequently according to symptoms and degree.

- Patient with a fever
- Patient with peripheral circulation insufficiency
- Neonate or low birth weight infant with delicate skin

WARNING

When monitoring SpO_2 of a patient who is receiving photodynamic therapy, the light from the finger probe sensor may cause a burn. Photodynamic therapy uses a photosensitizing agent that has a side effect of photosensitivity.

WARNING

When not monitoring SpO_2, disconnect the SpO_2 connection cord from the input unit. Otherwise, noise from the probe sensor may interfere and incorrect data is displayed on the screen.

CAUTION

Only use the specified probes. Otherwise, SpO_2 cannot be monitored.

CAUTION

Turn off the power of mobile phones, small wireless devices and other devices which produce strong electromagnetic interference around a patient (except for devices allowed by the hospital administrator). Radio waves from devices such as mobile phones or small wireless devices may be mistaken as pulse waves and the displayed data may be incorrect.

CAUTION

While a patient is on medication which causes vasodilation, the pulse waveform may change and in rare cases the SpO_2 value might not be displayed.

WARNING

To avoid poor circulation, do not wrap the tape too tight. Check the blood circulation condition by observing the skin color and congestion at the skin peripheral to the probe attachment site. Even for short-term monitoring, there may be burn or pressure necrosis from poor blood circulation, especially on neonates or low birth weight infants whose skin is delicate. Accurate measurement cannot be performed on a site with poor peripheral circulation.

CAUTION

Normal external light does not affect monitoring but strong light such as a surgical light or sunlight may affect monitoring. If affected, cover the measuring site with a blanket.

CAUTION

The following information are given by Masimo Corporation.

- A pulse oximeter should NOT be used as an apnea monitor.
- A pulse oximeter should be considered as early warning device. As a trend towards patient deoxygenation is indicated, blood sample should be analyzed by a laboratory co-oximeter to completely understand the patient's condition.

CAUTION

SpO_2 and pulse rate readings may be inaccurate for a short time after defibrillation when using Masimo probes.

NOTE

- Purchase of this instrument confers no express or implied license under any Masimo patent to use this instrument with any oximetry sensor that is not manufactured or licensed by Masimo Corporation.
- Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter. The SpO_2 measurement may be incorrect.

Silencing SpO_2 Alarm

This function is only available for BSM-6000A series. When the <SILENCE SpO_2 ALARM> on the ALARM window of the SYSTEM SETUP window is set to On, a second occurring SpO_2 alarm can be silenced when the [Silence Alarms] key is pressed. Refer to Section 3 of the Administrator's Guide.

NOTE

When the <SILENCE SpO_2 ALARM> is set to On and the monitored SpO_2 value is close to the SpO_2 upper and lower alarm limit setting, you may have to press the [Silence Alarm] key several times to silence the SpO_2 alarm.

When Monitoring Dual SpO_2

CAUTION

Some pulse oximeter alarms do not function on the bedside monitor when an pulse oximeter is connected. When the data is abnormal, check the alarm on the pulse oximeter.

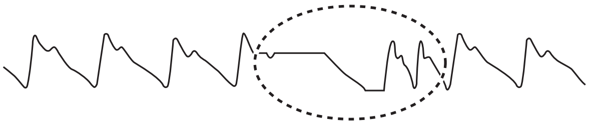
CAUTION

When two probes are attached too close to each other, the light from the probes interferes with each other and SpO_2 cannot be monitored properly. Make sure that there is no light interference when attaching two probes.

NOTE

- If a parameter is not monitored on the pulse oximeter, it is not displayed on the bedside monitor.
- Some parameters cannot be displayed on the bedside monitor even if they are monitored on the pulse oximeter.
- Waveforms from the pulse oximeter are not synchronized with the waveforms measured on the bedside monitor.
- When the pulse oximeter is operating in power save mode, the bedside monitor cannot receive data from the pulse oximeter. For details on the power save mode, refer to the pulse oximeter manual.
- The pulse waveform displayed on the bedside monitor is affected by the operation on the pulse oximeter. Depending on the status of the pulse oximeter, the pulse waveform displayed on the bedside monitor may differ from the actual waveform.

e.g. The pulse waveform on the bedside monitor becomes flat while the trendgraph on the pulse oximeter is updated.



Dual SpO_2 Function (SpO_2 Measurement at Two Sites)

When there is a right → left shunt in a patent ductus arteriosus (PDA), there will be a difference in oxygen saturation between the right upper limb (pre-ductal) and lower limb (post-ductal).

By connecting two SpO_2 probes to the bedside monitor, SpO_2 can be monitored at the upper limb and lower limb, and the SpO_2 difference (ΔSpO_2) can be calculated. The ΔSpO_2 is calculated by subtracting the SpO_2 value from the probe connected to the pulse oximeter (post-ductal) from the SpO_2 value from the probe connected to the SpO_2 socket (pre-ductal).

When there is a right → left shunt through the ductus arteriosus, the SpO_2 of the lower limb is lower than the SpO_2 of the right upper limb. Therefore, when the SpO_2 probe connected to the SpO_2 socket is attached to a right upper limb and the probe connected to the pulse oximeter is attached to a lower limb, the ΔSpO_2 is indicated as a plus value.

PPHN (Persistent Pulmonary Hypertension of Newborn) and Dual SpO_2

PPHN (Persistent Pulmonary Hypertension of Newborn) is a critical disease where elevated pulmonary vascular resistance and serious pulmonary hypertension remain after birth and there is a large right → left shunt through the ductus arteriosus.

For PPHN from the right → left shunt in a patent ductus arteriosus (PDA), it is reported that monitoring the difference in SpO_2 between right upper limb (preductal) and lower limb (post-ductal) is useful to diagnose PPHN, decide the timing of starting/stopping treatment, and decide the operation schedule.

Preparing for SpO_2 Monitoring

Preparation Flowchart

1. Select the probe.

2. When using an AY-631P or AY-633P input unit, connect the probe to the SpO_2 connection cord and connect the SpO_2 connection cord to the SpO_2 socket on the unit.

   When using an IF-925P communication cable, connect the probe to the Masimo pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-925P communication cable. For details, refer to the Masimo pulse oximeter and IF-925P communication cable manuals.

   When monitoring dual SpO_2:
   Connect the probe to the Masimo pulse oximeter and connect the pulse oximeter to the multi-link socket on the bedside monitor or JA-690PA or JA-694PA data acquisition unit with the IF-925P communication cable. For details, refer to the Masimo pulse oximeter and IF-925P communication cable manuals.

3. Attach the probe to the patient.

4. Monitoring starts. Set necessary settings.

Selecting a Probe and Patient Cable

Select the appropriate probe according to the purpose.

WARNING

Do not use additional tape to secure the probe to patient.

CAUTION

- Do not reuse adhesive probes for another patients because it causes cross infection.
- Do not use the probe over its stated lifetime. Otherwise the SpO_2 measurement accuracy cannot be guaranteed.
- Do not immerse the Masimo probe in water or any other solutions. The probe, cable and connectors are not waterproof.
- Do not sterilize the probe by irradiation, steam or ethylene oxide. Refer to the probe manual.

NOTE

When using a Masimo probe, read the instructions provided with the probe.

Masimo SpO_2 Probes

The following Masimo probes can be used with this bedside monitor. The Masimo probes are available direct from Masimo or their suppliers.

LNOP® Reusable Probes

Model	Patient	Weight Range	Measuring Accuracy		Application Site	Qty (/box)
			No Motion	Motion		
LNOP DCI	Adult, pediatric	>30 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNOP DCIP	Pediatric	10 to 50 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNOP YI	Neonate, pediatric, adult	>1 kg	1 to 3 kg: ±3%SpO_2 >3 kg: ±2%SpO_2	1 to 3 kg: ±3%SpO_2 >3 kg: ±3%SpO_2	Multi-site	1
LNOP TC-I	Adult, pediatric	>30 kg	±3.5%SpO_2	N/A	Ear lobe	1
LNOP DC-195	Adult, pediatric	>30 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNOP DCSC	Adult, pediatric	>30 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNOP DC-12	Adult	>30 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNOP TF-I	Adult	>30 kg	±2%SpO_2	N/A	Forehead	1

LNOP® Adhesive Probes

Model	Patient	Weight Range	Measuring Range		Application Site	Qty (/box)
			No Motion	Motion		
LNOP Adt	Adult	>30 kg	±2%SpO_2	±3%SpO_2	Finger	20
LNOP Pdt	Adult, pediatric	10 to 50 kg	±2%SpO_2	±3%SpO_2	Finger	20
LNOP Neo	Neonate	<10 kg	±3%SpO_2	±3%SpO_2	<3 kg: Foot >3 kg: Thumb or great toe	20
LNOP NeoPt	Neonate	<1 kg	±3%SpO_2	±3%SpO_2	Foot	20
LNOP Neo-L	Neonate, pediatric, adult	<3 kg >40 kg	<3 kg: ±3%SpO_2 >40 kg: ±2%SpO_2	<3 kg: ±3%SpO_2 >40 kg: ±3%SpO_2	<3 kg: Foot or toe >40 kg: Finger	20
LNOP NeoPt-L	Neonate	<1 kg	±3%SpO_2	±3%SpO_2	Foot	20
LNOP Inf-L	Neonate, pediatric	3 to 20 kg	±2%SpO_2	±3%SpO_2	Toe	20
LNOP Neo Bridge	Neonate	<10 kg	±3%SpO_2	±3%SpO_2	<3 kg: Foot >3 kg: Thumb or great toe	20
LNOP NeoPt Bridge	Neonate	<1 kg	±3%SpO_2	±3%SpO_2	Foot	20
LNOP Hi-Fi Trauma Neo/Adult	Adult, neonate	<3 kg >30 kg	<3 kg: ±3%SpO_2 >30 kg: ±2%SpO_2	<3 kg: ±3%SpO_2 >30 kg: ±3%SpO_2	<3 kg: Foot >30 kg: Finger	20
LNOP Hi-Fi Trauma Inf/Ped	Infant, pediatric	3 to 30 kg	3 to 10 kg: ±3%SpO_2 10 to 30 kg: ±2%SpO_2	3 to 10 kg: ±3%SpO_2 10 to 30 kg: ±3%SpO_2	Finger or toe	20
LNOP Blue Inf	Neonate, pediatric	2.5 to 30 kg	±3 (for 80 to 100%SpO_2) ±4 (for 60 to 80%SpO_2)	N/A	Great toe	20
LNOP Adtx	Adult, pediatric	>30 kg	±2%SpO_2	±3%SpO_2	Finger	20
LNOP Pdtx	Pediatric	10 to 50 kg	±2%SpO_2	±3%SpO_2	Finger	20

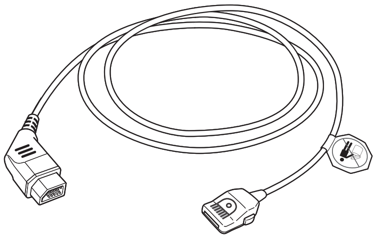
LNCS™ Reusable Probes

Model	Patient	Weight Range	Measuring Accuracy		Application Site	Qty (/box)
			No Motion	Motion		
LNCS DCI	Adult, pediatric	>30 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNCS DCIP	Pediatric	10 to 50 kg	±2%SpO_2	±3%SpO_2	Finger	1
LNCS TC-I	Adult, pediatric	>30 kg	±3.5%SpO_2	N/A	Ear lobe	1
LNCS TF-I	Adult, pediatric	>30 kg	±2%SpO_2	N/A	Forehead	1

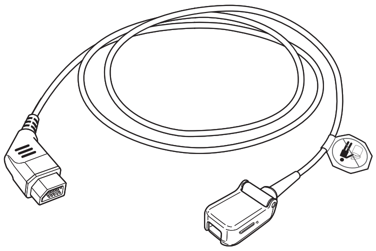
LNCS™ Adhesive Probes

Model	Patient	Weight Range	Measuring Accuracy		Application Site	Qty (/box)
			No Motion	Motion		
LNCS Adtx	Adult, pediatric	>30 kg	±2%SpO_2	±3%SpO_2	Finger	20
LNCS Pdtx	Adult, pediatric	10 to 50 kg	±2%SpO_2	±3%SpO_2	Finger	20
LNCS Inf-L	Neonate, pediatric	3 to 20 kg	±2%SpO_2	±3%SpO_2	Toe	20
LNCS Neo-L	Neonate, pediatric, adult	<3 kg >40 kg	±3%SpO_2 ±2%SpO_2	±3%SpO_2 ±3%SpO_2	<3 kg: Foot or toe >40 kg: Finger	20
LNCS NeoPt	Neonate	<1 kg	±3%SpO_2	±3%SpO_2	Foot	20

SpO_2 Connection Cords



Use the JL-630P SpO_2 connection cord (3.6 m) for the LNOP series probes.

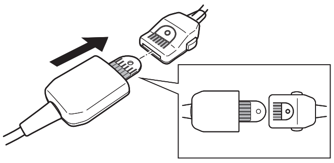


Use the JL-631P SpO_2 connection cord (3.0 m) for the LNCS series probes.

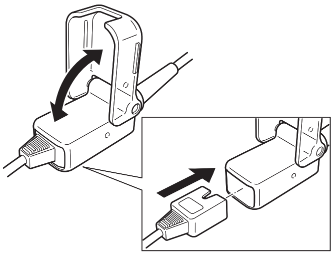
Connecting Cables and Attaching the Probes

Connecting Cable to the Unit

Using an AY-631P or AY-633P Input Unit

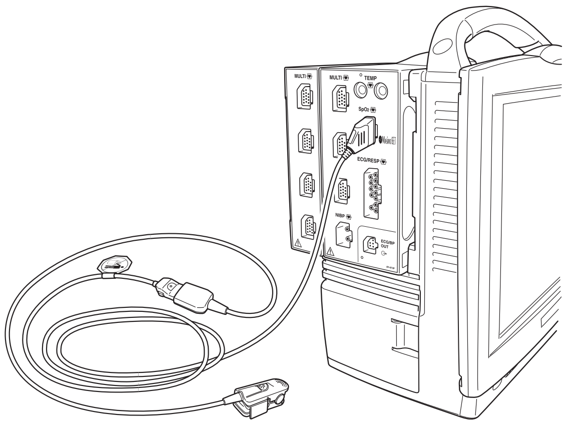


1. When using the LNOP series probes, insert the probe connector into the connector of the JL-630P SpO_2 connection cord.

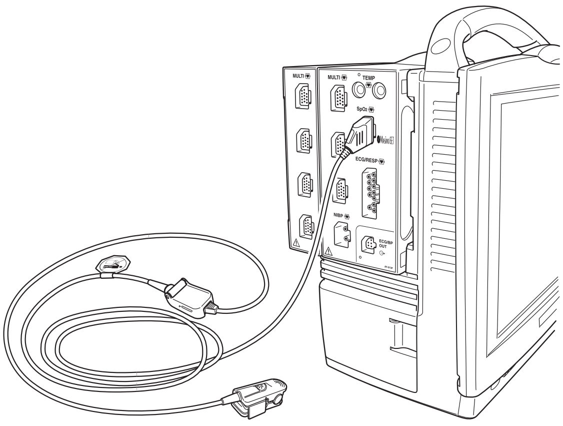


When using the LNCS series probes, open the stopper of the JL-631P SpO_2 connection cord, connect the probe connector firmly, then close the stopper. Check that the stopper clicks and is firmly closed.

2. Connect the SpO$_2$ connection cord to the SpO$_2$ socket on the unit.



When connecting the LNOP series probe



When connecting the LNCS series probe

Using an IF-925P Communication Cable

1. Connect an SpO$_2$ probe to the Masimo pulse oximeter. Refer to the pulse oximeter manual.

2. Connect the IF-925P communication cable to the pulse oximeter. Refer to the communication cable manual.

3. Connect the communication cable to the multi-link socket on the unit.

SpO$_2$ Measurement at Two Sites

Using an AY-631P or AY-633P Input Unit

1. Connect the probe to the SpO$_2$ connection cord and connect the SpO$_2$ connection cord to the SpO$_2$ socket on the input unit.

2. Connect another SpO$_2$ probe to the Masimo pulse oximeter. Refer to the pulse oximeter manual.

3. Connect the IF-925P communication cable to the pulse oximeter. Refer to the communication cable manual.

4. Connect the communication cable to the multi-link socket on the unit.

Using an IF-925P Communication Cable

Uses two Masimo pulse oximeters. Connect an SpO$_2$ probe to each Masimo pulse oximeter and connect the pulse oximeters to the multi-link sockets on the unit with the IF-925P communication cables.

Attaching the Probe to the Patient

Refer to the probe manual.

Monitoring SpO_2

When the preparation is done properly, the SpO_2 value and pulse waveform appear on the screen.

The SpO_2 value acquired from the SpO_2 probe connected to the SpO_2 socket is displayed as “SpO_2” value and the SpO_2 value acquired from the SpO_2 probe connected to the pulse oximeter is displayed as “SpO_2-2” value on the screen.

CAUTION

When the probe is attached on an appropriate site with sufficient circulation and an error message about probe attachment repeatedly appears, the probe may be deteriorated. Replace it with a new one.

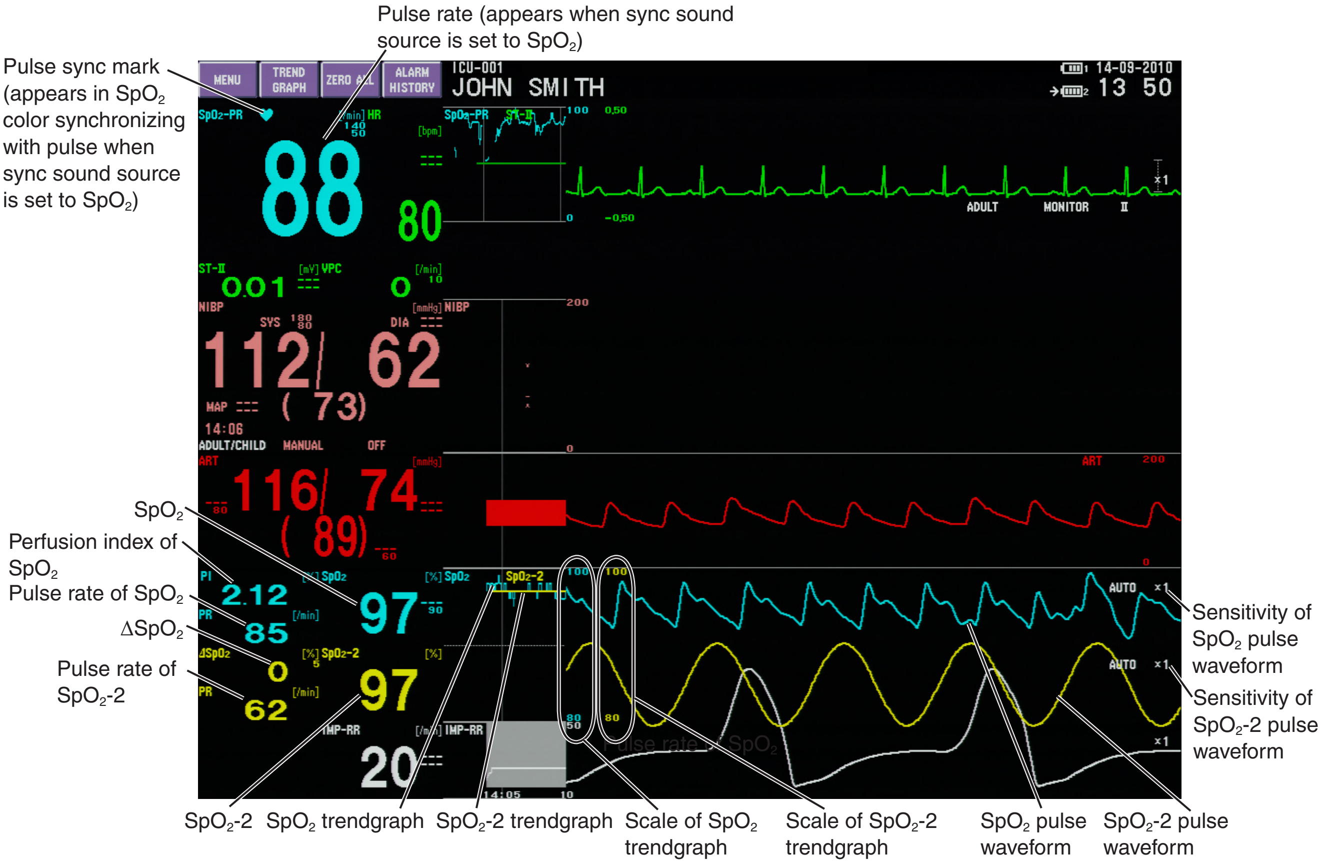
CAUTION

When a message indicates a faulty probe or faulty SpO_2 connection cord, stop monitoring and replace the probe or SpO_2 connection cord with a new one.

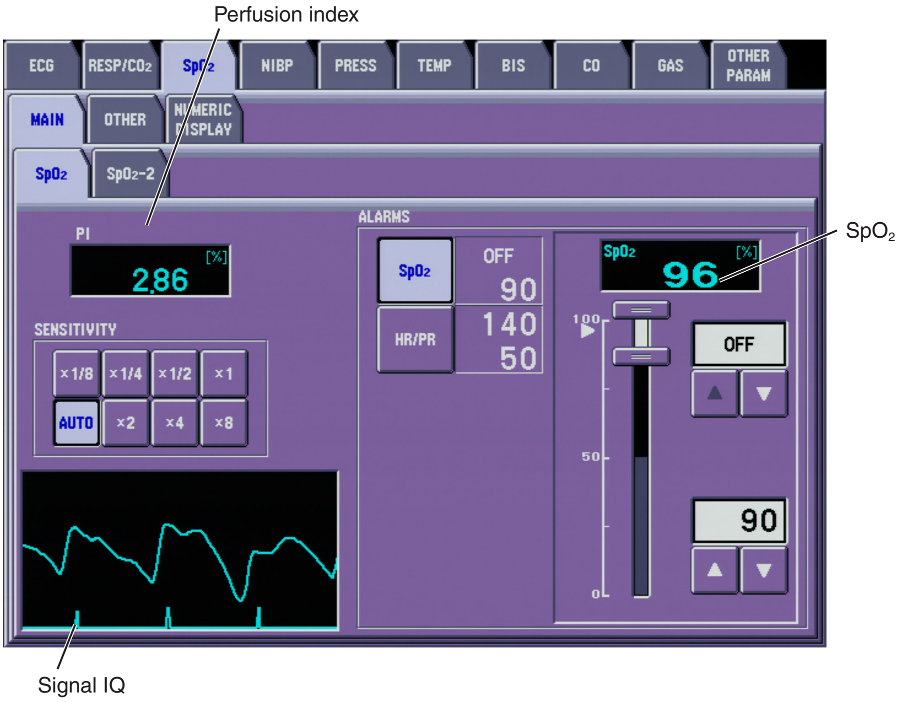
NOTE

In order to maintain sufficient blood circulation, keep the measurement site warm by covering with a blanket or something similar. Warming the site is effective, especially for a patient with a small pulse amplitude.

SpO_2 Information on the Home Screen


Pulse rate (appears when sync sound source is set to SpO₂)
Pulse sync mark (appears in SpO₂ color synchronizing with pulse when sync sound source is set to SpO₂)
SpO₂
Perfusion index of SpO₂
Pulse rate of SpO₂
ΔSpO₂
Pulse rate of SpO₂-2
Sensitivity of SpO₂ pulse waveform
Sensitivity of SpO₂-2 pulse waveform
SpO₂-2
SpO₂ trendgraph
SpO₂-2 trendgraph
Scale of SpO₂ trendgraph
Scale of SpO₂-2 trendgraph
SpO₂ pulse waveform
SpO₂-2 pulse waveform
MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
14-09-2010
13 50
SpO2-PR
88
HR
80
ST-II
0.01
VPC
0
NIBP
112/ 62
(73)
14:06
ADULT/CHILD
MANUAL
OFF
ART
116/ 74
(89)
PI
2.12
PR
85
dSpO2
0
SpO2
97
SpO2-2
97
PR
62
IMP-RR
20
ADULT
MONITOR
II
AUTO
x1

SpO$_2$ Information on the SpO$_2$ Window


Perfusion index
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO2
SpO2-2
PI
[%]
2.86
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8
ALARMS
SpO2
OFF
90
HR/PR
140
50
SpO2 [%]
96
100
50
0
OFF
90
SpO$_2$
Signal IQ

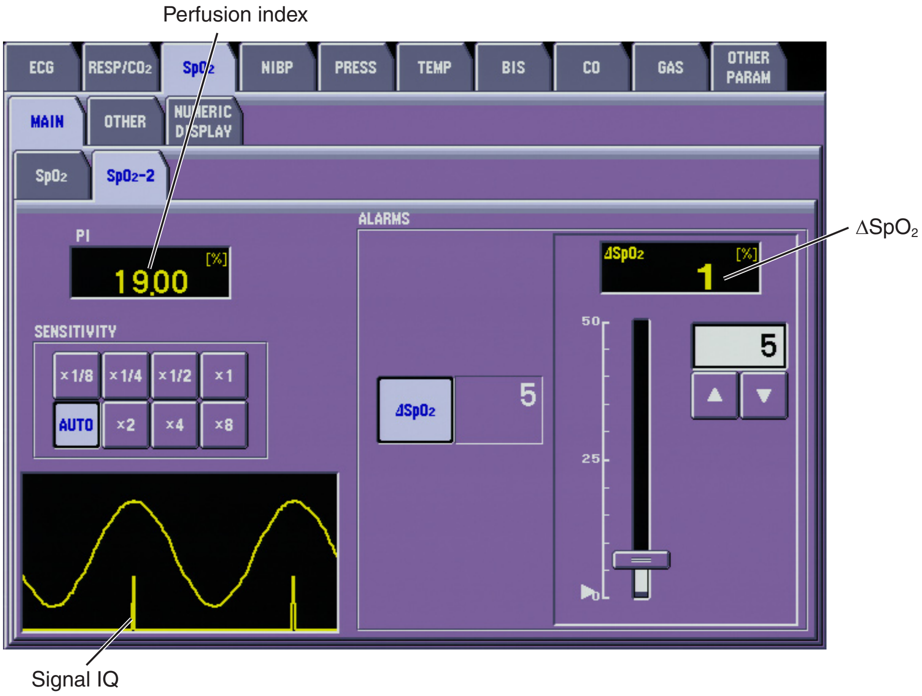
Signal IQ

Signal IQ is the signal quality indicator. Signal IQ can be used to identify the occurrence of a patient’s pulse and the associated signal quality of the measurement. The pulse waveform is often distorted when there is motion and may be obscured by artifact. The Signal IQ, shown as a vertical line, coincides with the peak of an arterial pulsation. The height of the vertical line of the Signal IQ indicates the quality of the measured signal. The taller the height, the higher the signal quality. When the signal quality is very low, the height of the vertical line becomes low and an “M” mark is displayed beside the SpO$_2$ value.

PI (Perfusion Index)

The Perfusion Index indicates the percentage of pulsatile signal to non-pulsatile signal. The range of Perfusion Index is 0.02% (very weak pulse strength) to 20% (very strong pulse strength). The Perfusion Index allows clinicians to place sensors on optimal sites. Placing the sensor at the site with the highest Perfusion Index number improves performance during motion.

SpO_2 Information on the SpO_2-2 Window


Perfusion index
ΔSpO2
Signal IQ
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO2
SpO2-2
PI
ALARMS
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8
ΔSpO2
50
25
0
▲
▼

PI [%] 19.00

ΔSpO2 [%] 1

ΔSpO2 5

Changing SpO$_2$ Settings

Change settings on the SpO$_2$ window. The following settings can be changed for SpO$_2$ monitoring.

The following settings can be changed on the SpO$_2$ tab.

- Pulse waveform sensitivity
- SpO$_2$ and pulse rate alarm limits*
- Averaging time*
- Sensitivity mode*
- FAST SAT mode on or off*
- Display pulse rate and/or perfusion index in SpO$_2$ numeric data area on the home screen

* These settings are not available for SpO$_2$ monitored by a Masimo pulse oximeter.

The following settings can be changed on the SpO$_2$-2 tab for dual SpO$_2$ monitoring.

- Pulse waveform sensitivity
- ΔSpO$_2$ alarm limit
- Display SpO$_2$-2 pulse rate, perfusion index and/or ΔSpO$_2$ in SpO$_2$-2 numeric data area on the home screen

The following settings are common settings for SpO$_2$ and SpO$_2$-2. These settings are not available for SpO$_2$ monitored by a Masimo pulse oximeter

- Sync source
- Sync sound pitch

The SpO$_2$ data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

The scale of the SpO$_2$ trendgraph on the home screen is the same scale as the trendgraph of the Review window. Refer to Operator’s Manual or Section 6 of the User’s Guide Part I.

The SpO$_2$ pulse waveform sweep speed and the waveform display on the home screen can be selected on the DISPLAY window. Refer to Section 3 of the User’s Guide Part I.

Changing the Sensitivity

The sensitivity determines the size of the pulse waveform on both the screen and recording paper.

The sensitivity can be set manually or automatically. When you select auto sensitivity, the sensitivity is automatically determined according to the present SpO$_2$ pulse waveform. When sensitivity is set automatically, “AUTO” appears beside the sensitivity on the screen.

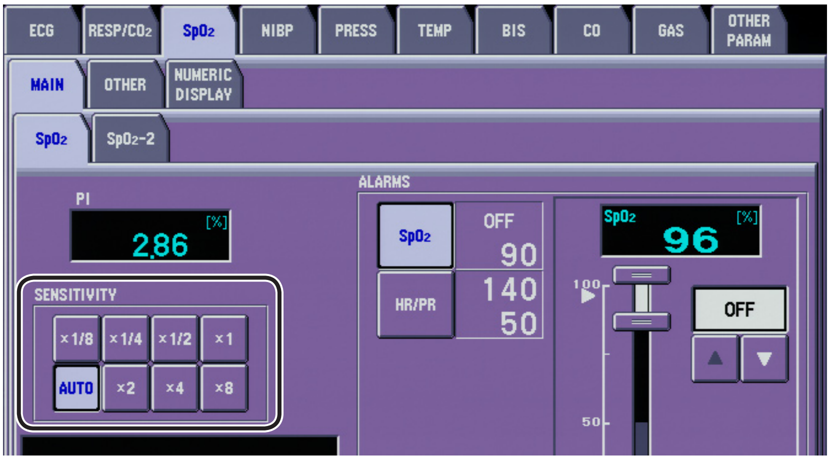
For the pulse waveform monitored by Masimo pulse oximeter, the sensitivity cannot be set automatically.

NOTE

The pulse wave amplitude varies according to the ratio of the pulsation component to the entire transmitted IR signal. When the pulsation component ratio is 1%, the pulse wave amplitude is about 10 mm at ×1 sensitivity on the display.

1. SpO$_2$: Display the SpO$_2$ tab of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → MAIN tab → SpO$_2$ tab.
   SpO$_2$-2: Display the SpO$_2$-2 tab of the SpO$_2$-2 window.
   Press [Menu] key → SpO$_2$ key → MAIN tab → SpO$_2$-2 tab.

2. Select the sensitivity from ×1/8, ×1/4, ×1/2, ×1, ×2, ×4, ×8 or AUTO in the <SENSITIVITY> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO2
SpO2-2
PI
[%]
2.86
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8
ALARMS
SpO2
HR/PR
OFF
90
140
50
SpO2
[%]
96
100
50
OFF
▲
▼

3. Press the [Home] key to return to the home screen.

Changing the SpO$_2$ and Pulse Rate Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

NOTE

When using a Masimo pulse oximeter, SpO_2 and pulse rate alarm settings on the pulse oximeter are displayed on the SpO_2 window. Alarm settings can only be set on the pulse oximeter.

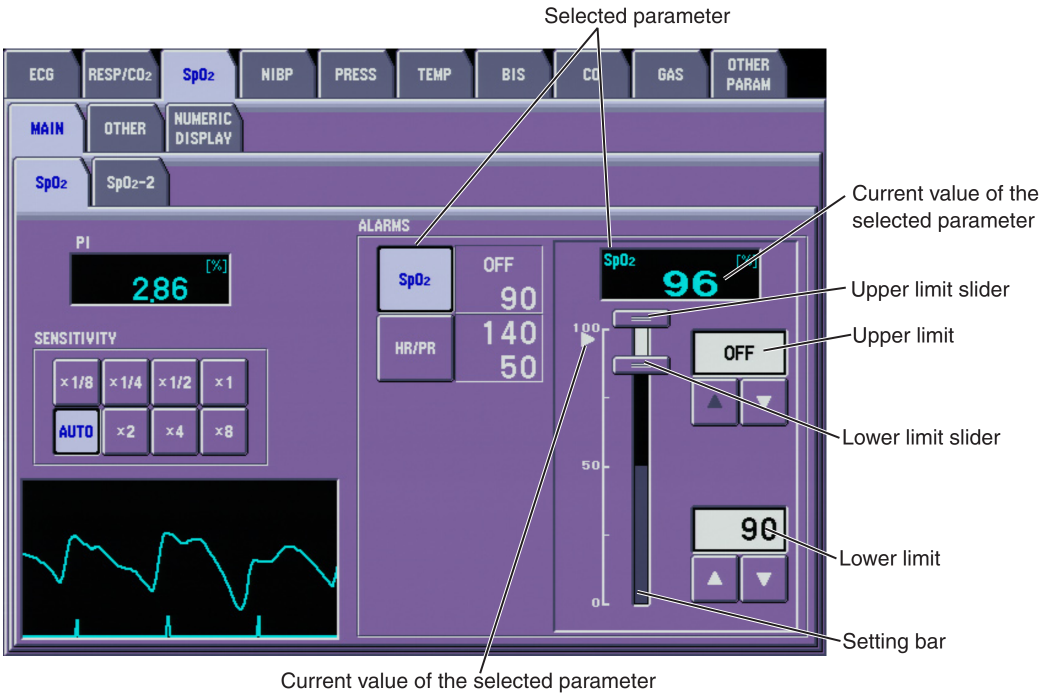
You can set the upper and lower SpO_2 and heart rate/pulse rate alarm limits on the SpO_2 window. You can set all alarms, including the upper and lower SpO_2 and pulse rate alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I). The heart rate/pulse rate alarm limits can also be changed on the ECG and PRESS window.

Setting Range

SpO_2 upper limit: 51 to 100%SpO_2 in 1%SpO_2 steps, OFF
(default setting: OFF)
SpO_2 lower limit: OFF, 50 to 99%SpO_2 in 1%SpO_2 steps
(default setting: 90)
HR/PR upper limit: When <SYNC SOURCE> is set to ECG:
16 to 300 beats/min in 1 beat/min steps, OFF
When <SYNC SOURCE> is set to PRESS or SpO_2:
31 to 300 beats/min in 1 beat/min steps, OFF
(default setting: OR/ICU-140, NICU-200)
HR/PR lower limit: When <SYNC SOURCE> is set to ECG:
OFF, 15 to 299 beats/min in 1 beat/min steps
When <SYNC SOURCE> is set to PRESS or SpO_2:
OFF, 30 to 299 beats/min in 1 beat/min steps
(default setting: OR/ICU-50, NICU-100)
ΔSpO_2 upper limit: OFF, 1 to 50%SpO_2 in 1%SpO_2 steps
(default setting: 5)

1. SpO_2: Display the SpO_2 tab of the SpO_2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2 tab.
   SpO_2-2: Display the SpO_2-2 tab of the SpO_2-2 window.
   Press [Menu] key → SpO_2 key → MAIN tab → SpO_2-2 tab.

2. Touch the SpO_2 key to change the SpO_2 alarm setting.
   Touch the HR/PR key to change the heart rate/pulse rate alarm setting.
   Touch the ΔSpO_2 key on the SpO_2-2 tab to change the ΔSpO_2 alarm setting.


Selected parameter
ECG
RESP/CO$_2$
SpO$_2$
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SpO$_2$
SpO$_2$-2
PI
[%]
2.86
SENSITIVITY
×1/8
×1/4
×1/2
×1
AUTO
×2
×4
×8
ALARMS
SpO$_2$
OFF
90
HR/PR
140
50
SpO$_2$
[%]
96
100
50
0
OFF
90
Current value of the selected parameter
Upper limit slider
Upper limit
Lower limit slider
Lower limit
Setting bar
Current value of the selected parameter

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Changing the Sync Sound Source

This setting is not available for SpO$_2$ monitored by a Masimo pulse oximeter.

You can select ECG, SpO$_2$ pulse (SpO$_2$) or arterial blood pressure pulse (PRESS) as the sync source. When the arterial blood pressure pulse is selected, the blood pressure of the highest priority label is used. The sync source can also be changed on the ECG and PRESS windows.

When pulse wave and pressure waveform are irregular because of an IABP, select ECG.

NOTE

- When heart rate is unstable because of an ESU, select SpO$_2$ or PRESS.
- When the connection cord of SpO$_2$ or IBP of the arterial blood pressure is disconnected from the monitor and alarm occurs when the sync source is set to SpO$_2$ or PRESS, the sync source changes to ECG when the alarm is silenced by pressing the [Silence Alarms] key. The sync source returns to SpO$_2$ or PRESS when the SpO$_2$ or IBP is monitored again. When using PRESS as the sync source, adjust zero balance.
- When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO$_2$ or PRESS, the sync source does not

change to ECG when the alarm is silenced and PR is displayed “- - -”.

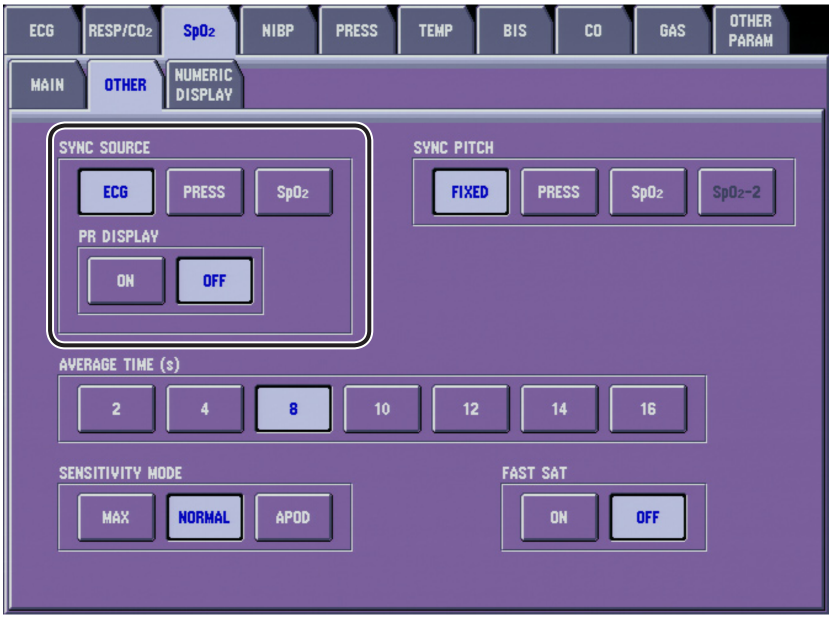
When the sync source is set to ECG and ECG is not measured, there is no sync sound.

When SpO$_2$ or PRESS is selected, the pulse rate can be displayed to the left of the heart rate on the screen and the sync mark synchronizes with the pulse.

1. Display the OTHER page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → OTHER tab.

2. Select the sync source in the <SYNC SOURCE> box.
   ECG: QRS
   PRESS: Pulse wave of the highest priority arterial blood pressure
   SpO$_2$: SpO$_2$ pulse

   To display the pulse rate to the left of the heart rate on the home screen, select ON for <PR DISPLAY>. This setting is only available when <SYNC SOURCE> is set to ECG.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
AVERAGE TIME (s)
2
4
8
10
12
14
16
SENSITIVITY MODE
MAX
NORMAL
APOD
FAST SAT
ON
OFF

3. Press the [Home] key to return to the home screen.

Selecting Sync Sound Pitch

This setting is not available for SpO$_2$ monitored by a Masimo pulse oximeter.

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set on the SYSTEM SETUP window (see Section 3 of the Administrator’s Guide). When you select variable pitch, the pitch of the sync sound changes according to SpO$_2$ value or systolic BP value of the arterial blood pressure so that you can recognize the change on the patient from the pitch of the sync sound without looking at the monitor. The sync pitch can also be changed on the ECG and PRESS windows.

When the sync sound source is set to SpO_2 and the SpO_2 value is below 81%SpO_2, the low pitch is automatically selected.

When the sync sound source is set to SpO_2 and the “CHECK PROBE” or “DETECTING PULSE” message is displayed on the screen, the sync sound stops.

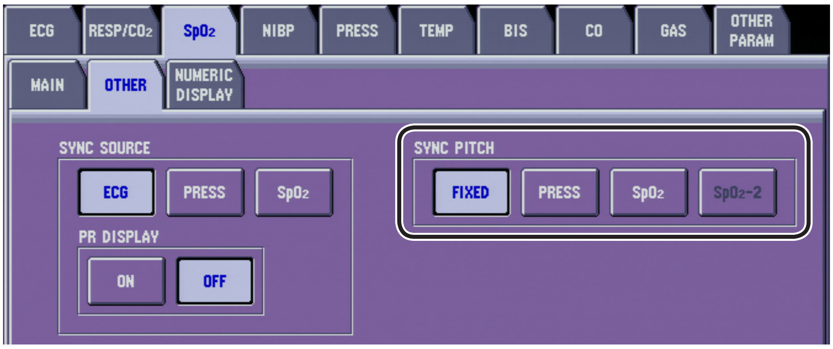
When the sync sound source is set to ECG or PRESS, the sync pitch is set to SpO_2 and the SpO_2 cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2, the sync pitch is set to PRESS and the IBP cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2 and the IBP connection cord is disconnected, the low pitch is automatically selected. After connecting the IBP connection cord, adjust zero balance.

1. Display the OTHER page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → OTHER tab.

2. Select the sync sound pitch from the <SYNC PITCH> box.
   FIXED: The pitch is fixed to the pitch selected on the SYSTEM SETUP window.
   PRESS: The pitch is high when the BP value is above 120 mmHg. The pitch is low when the BP value is below 20 mmHg. The pitch changes from high to low in 20 steps for each 5 mmHg change between 120 and 20 mmHg BP value. The BP value of the highest priority arterial blood pressure is used.
   SpO_2: The pitch changes in 20 steps from high to low for each 1%SpO_2 change in SpO_2 value between 100%SpO_2 and 81%SpO_2.



3. Press the [Home] key to return to the home screen.

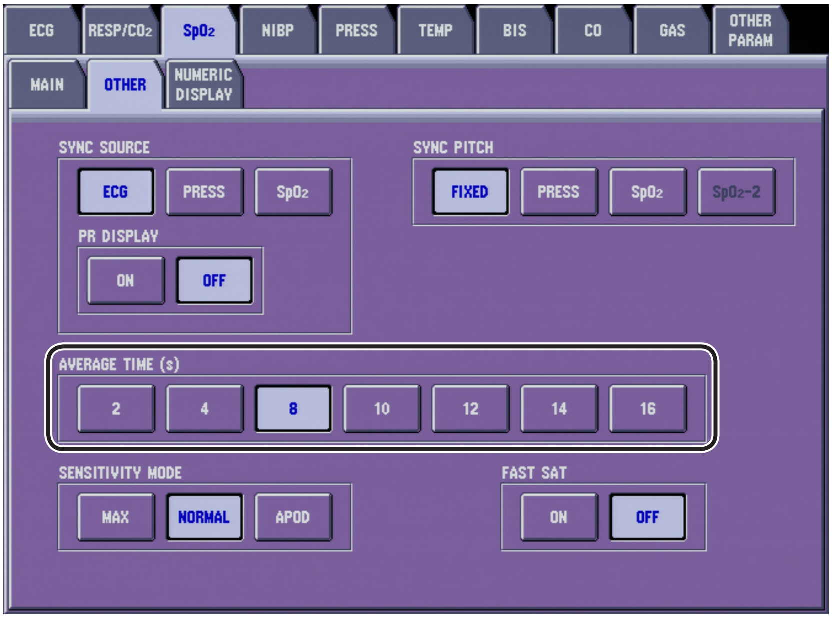
Selecting the Averaging Time

This setting is not available for SpO$_2$ monitored by a Masimo pulse oximeter.

Select the averaging time.

1. Display the OTHER page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → OTHER tab.

2. Select the averaging time from the <AVERAGE TIME> box.



ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PR DISPLAY
ON
OFF
AVERAGE TIME (s)
2
4
8
10
12
14
16
SENSITIVITY MODE
MAX
NORMAL
APOD
FAST SAT
ON
OFF

3. Press the [Home] key to return to the home screen.

Selecting the Sensitivity Mode

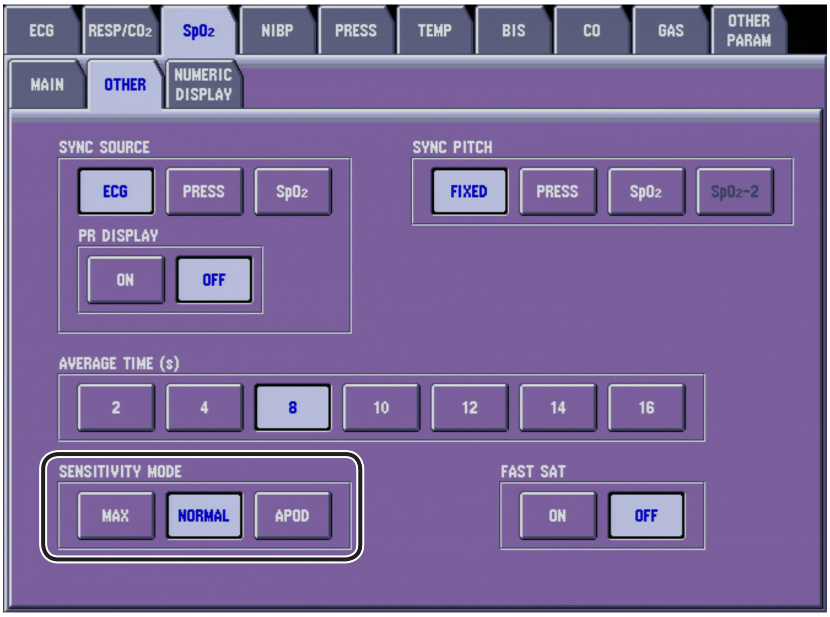
This setting is not available for SpO$_2$ monitored by a Masimo pulse oximeter.

There are three sensitivity modes to enable accurate measurements according to patient conditions.

MAX:	This mode should be used for a critical patient, where obtaining a reading is most difficult. MAX mode is designed to interpret and display data for even the weakest of signals. This mode is recommended during procedures and when clinician and patient contact is continuous.
NORMAL:	This mode provides the best combination of sensitivity and probe-off detection performance. This mode is recommended for most patients.
APOD:	APOD (Adaptive Probe Off Detection) is the least sensitive in picking up a reading on patients with low perfusion but has the best detection for probe-off conditions. This mode is useful for patients that are at particular risk of the sensor becoming detached (pediatric, body movement, etc.).

1. Display the OTHER page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → OTHER tab.

2. Select the mode from the <SENSITIVITY MODE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
AVERAGE TIME (s)
2
4
8
10
12
14
16
SENSITIVITY MODE
MAX
NORMAL
APOD
FAST SAT
ON
OFF

3. Press the [Home] key to return to the home screen.

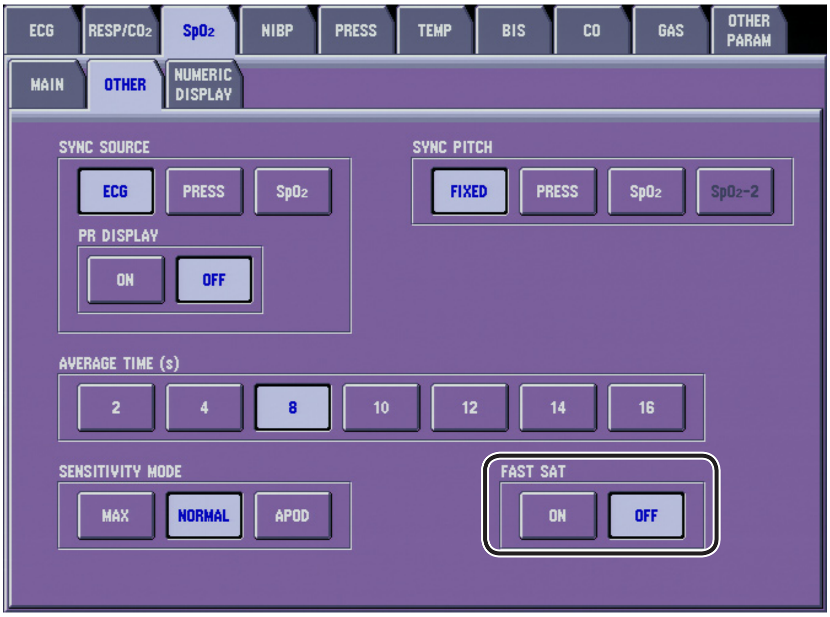
Turning FAST SAT Mode On or Off

This setting is not available for SpO$_2$ monitored by a Masimo pulse oximeter.

FAST SAT enables rapid tracking of arterial oxygen saturation changes by minimizing the averaging. This mode is clinically applicable during procedures when detecting rapid changes in oxygen saturation is most important such as induction, intubation and sleep studies.

1. Display the OTHER page of the SpO$_2$ window.
   Press [Menu] key → SpO$_2$ key → OTHER tab.

2. Select the ON or OFF in the <FAST SAT> box.

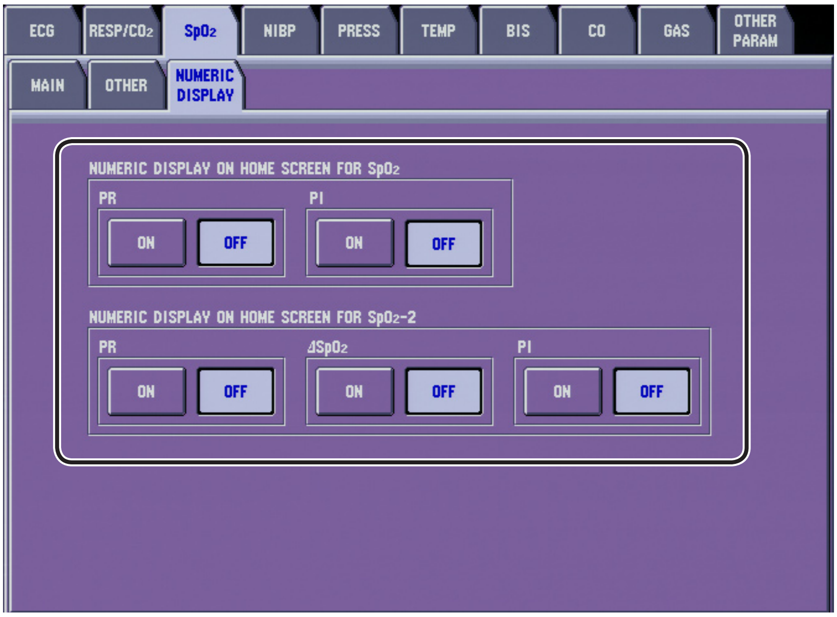

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
AVERAGE TIME (s)
2
4
8
10
12
14
16
SENSITIVITY MODE
MAX
NORMAL
APOD
FAST SAT
ON
OFF

3. Press the [Home] key to return to the home screen.

Displaying Pulse Rate, ΔSpO_2 and Perfusion Index (PI) on the Home Screen

The pulse rate and perfusion index (PI) display in SpO_2 and SpO_2-2 area and the ΔSpO_2 display in SpO_2-2 area on the home screen can be set to on or off. For the numeric display in SpO_2-2 area, pulse rate and either ΔSpO_2 or PI can be displayed.

1. Display the NUMERIC DISPLAY page of the SpO_2 window.
   Press [Menu] key → SpO_2 key → NUMERIC DISPLAY tab.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
OTHER
NUMERIC DISPLAY
NUMERIC DISPLAY ON HOME SCREEN FOR SpO2
PR
ON
OFF
PI
ON
OFF
NUMERIC DISPLAY ON HOME SCREEN FOR SpO2-2
PR
ON
OFF
ΔSpO2
ON
OFF
PI
ON
OFF

2. Select ON or OFF for each parameter in the <NUMERIC DISPLAY ON HOME SCREEN FOR SpO_2> and/or <NUMERIC DISPLAY ON HOME SCREEN FOR SpO_2-2> box.

3. Press the [Home] key to return to the home screen.

Section 5 NIBP Monitoring

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Preparing for NIBP Measurement 5.3
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    Selecting the Cuff 5.3
    Types of Cuffs 5.4
        Reusable Cuffs 5.4
        Disposable Cuffs 5.5
    Connecting Cables and Attaching the Cuff to the Patient 5.6
        Connecting Air Hose and Cuff to the Unit 5.6
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    Measurement Mode and Interval 5.10
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        Auto Measurement with PWTT 5.11
        STAT Measurement 5.13
        SIM Mode Measurement 5.13
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    Selecting the Initial Cuff Inflation Pressure 5.23
        Selecting the Initial Cuff Inflation Pressure Type 5.23
        Setting the Cuff Inflation Pressure 5.24
    Changing the NIBP Alarm Limits 5.25
    Changing the PWTT Settings 5.26
Using Venous Puncture Mode 5.28

The NIBP measurement is suitable for use in the presence of electrosurgery and during the discharge of a cardiac defibrillator. This monitor complies with IEC 60601-2-30: 1999.

General

Non-invasive blood pressure is measured by the oscillometric method in which the cuff is wrapped on the patient arm (or thigh) and connected to the NIBP socket on the input unit.

Oscillometric method

The NIBP is measured from the change in amplitude pattern of pulsatile oscillation in cuff pressure as the cuff pressure is reduced from above systolic to below diastolic pressure. The occlusive-oscillometry method uses this to determine the systolic, diastolic, and mean arterial pressure.

The systolic pressure is the pressure at which the pulsatile oscillation suddenly increases, and the diastolic pressure is the pressure at which the pulsatile oscillation suddenly decreases. The mean arterial pressure is the point where maximum pulsatile oscillation occurs.

This monitor has four NIBP measurement modes.

• Manual measurement	Measurement is performed once.
• Automatic measurement	Measurement is performed automatically at preset time intervals. The time interval can be selected. Automatic measurement can also be performed with PWTT.
• STAT measurement	Measurement is performed for 10 minutes (maximum) continuously.
• SIM mode measurement	Measurement is performed in Staged Interval Mode (SIM). This mode is only available in OR site and when SIM is set to ON on the SYSTEM SETUP window. To change the site and SIM setting, refer to Section 3 of the Administrator’s Guide.

WARNING

Be careful when measuring NIBP on a patient with known bleeding disorders or coagulation. After NIBP measurement, there may be dot hemorrhage, or circulatory disorder by thrombus where the cuff is attached.

WARNING

NIBP measurement may be incorrect in the following cases.

- When using an electrosurgical unit
- When there is body movement
- When the pulse wave is small (insufficient peripheral circulation)
- Too many arrhythmias
- When there is vibration
- When there is a rapid blood pressure change
- During CPR

Preparing for NIBP Measurement

Preparation Flowchart

1. Select the cuff.
2. Connect the cuff to the air hose and connect the air hose to the NIBP socket on the unit.
3. Attach the cuff to the patient.
4. Set necessary settings, such as initial cuff inflation pressure.
5. Start measurements.

Selecting the Cuff

Select the appropriate cuff according to the purpose.

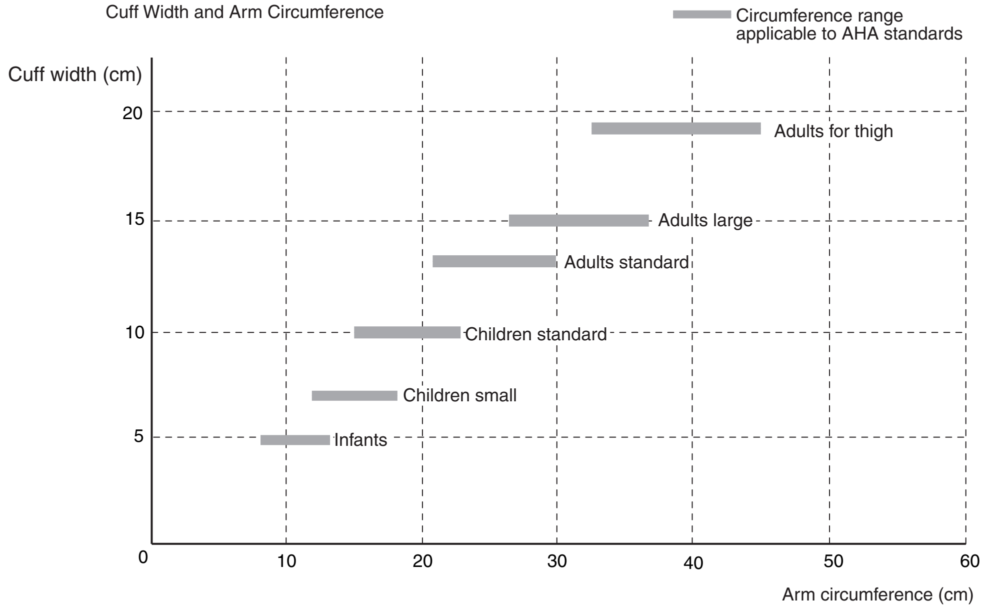
The AHA (American Heart Association) recommends that the cuff width be 40% of the circumference of the upper arm. Refer to the following graph and select the cuff which suits the patient's arm.

NOTE

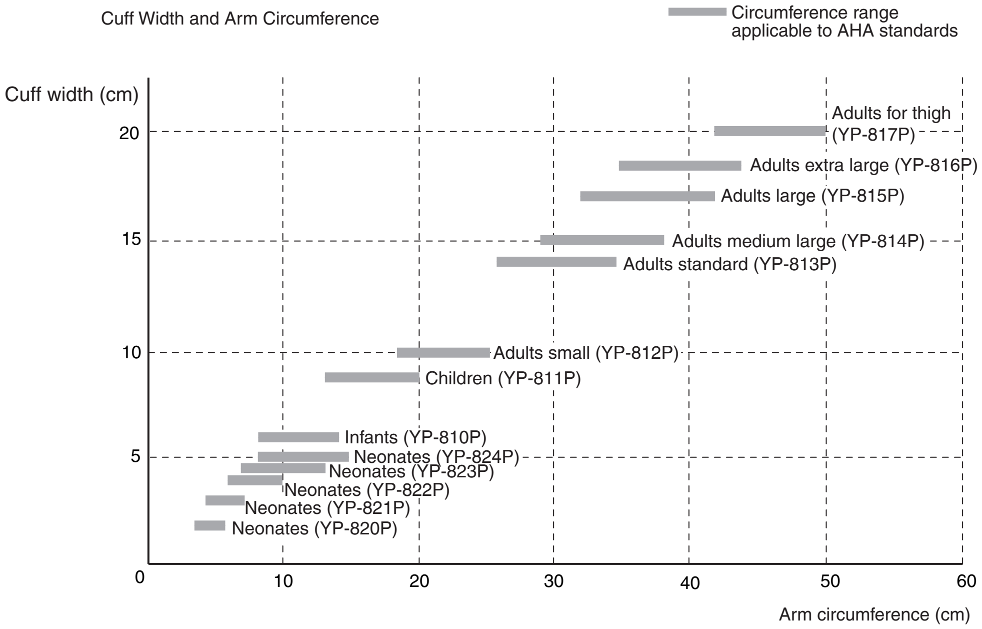
- If the range of arm circumference appropriate for the cuff is prescribed, use within that range.
- To obtain accurate measured values, select a wide cuff which can be attached to the upper arm or the thigh (calf in the case of neonates). Measuring with a very narrow cuff may result in measured values higher than the actual values.

Cuff Width and Arm Circumference

Reusable cuffs



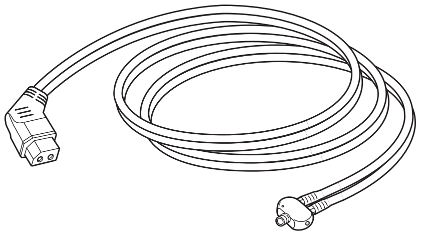
Disposable cuffs



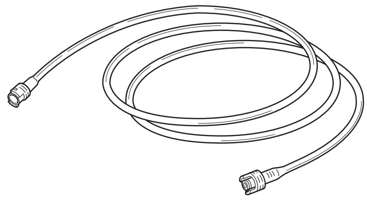
Types of Cuffs

Reusable Cuffs

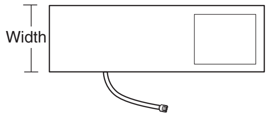
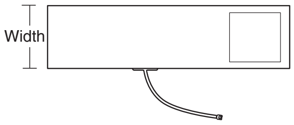
When using the following reusable cuffs, a YN-900P (1.5 m) or YN-901P (3.5 m) air hose is required. A YN-990P (1.5 m) extension hose is also available.



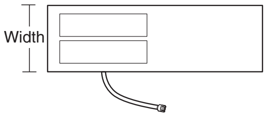
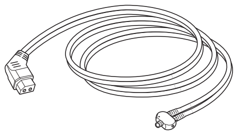
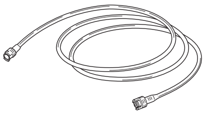
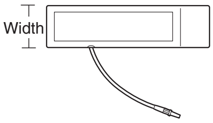
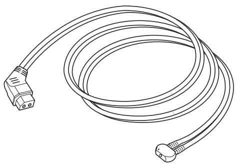
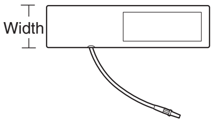
YN-900P Air hose



YN-990P Extension hose

Cuff			Width (cm)	Applicable Circumference (cm)	Shape
For infants		YP-960T	5	8 to 13	
For children	Small	YP-961T	7	12 to 18	
	Standard	YP-702T YP-962T	10	15 to 23	
For adults	Standard	YP-703T YP-963T	13	21 to 30	
	Large	YP-964T	15	26 to 36	
For thigh		YP-965T	19	33 to 45	

Disposable Cuffs

Cuff			Width (cm)	Applicable Circumference (cm)	Shape	Air Hose
Infants (Non-sterilized)		YP-810P	6	8 to 14		YN-900P (1.5 m) YN-901P (3.5 m)  Extension hose YN-990P (1.5 m) 
Children (Non-sterilized)		YP-811P	8	13 to 20		
Adults (Non-sterilized)	Small	YP-812P	10	18 to 26		
	Standard	YP-813P	14	26 to 35		
	Medium large	YP-814P	15	29 to 38		
	Large	YP-815P	17	32 to 42		
	Extra large	YP-816P	18	35 to 44		
For thigh		YP-817P	20	42 to 50		
Neonates (Non-sterilized)		YP-820P	2	3 to 6		YN-920P (1.5 m) YN-921P (3.5 m) 
		YP-821P	3	4 to 8		
		YP-822P	4	6 to 10		
		YP-823P	4.5	7 to 13		
		YP-824P	5	8 to 15		
Neonates (Sterilized)		No. 11*	3	5 to 7.5		
		No. 12*	4	7.5 to 10.5		
		No. 13*	5	8.5 to 13		

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Connecting Cables and Attaching the Cuff to the Patient

Connecting Air Hose and Cuff to the Unit

CAUTION

Firmly connect the air hose to the NIBP socket on the monitor until it clicks. If not connected properly, the cuff type cannot be identified. Check that the cuff type is correctly identified on the monitoring screen.

NOTE

Firmly connect the air hose to the cuff and the unit. The air leakage will cause incorrect NIBP data or no data.

The monitor automatically identifies the type of air hose (adult/child or neonate) when the air hose is connected to the NIBP socket. The cuff inflation pressure is automatically changed according to the identified air hose type. The air hose type is displayed on the home screen.

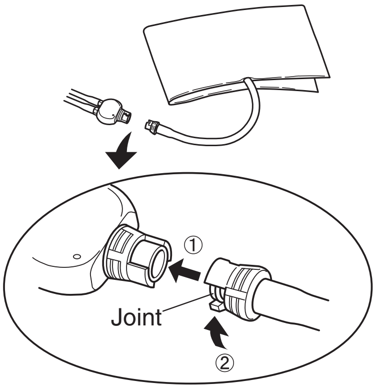
NOTE

The alarm settings are not automatically changed according to the air hose type. The alarm settings which are appropriate for the patient must be manually set.

1. Connect the cuff to the air hose.

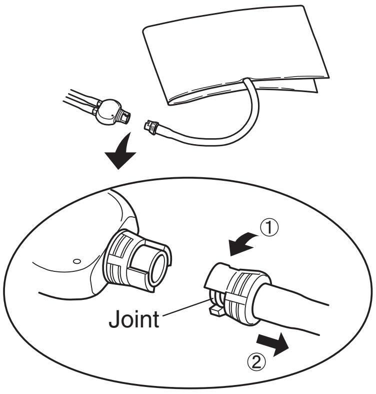
Connecting the Cuff for Adults and Children

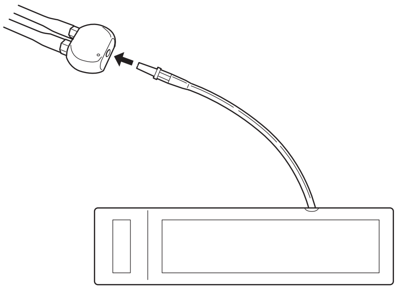
Insert the cuff connector joint into the air hose and turn it clockwise to lock it.



Disconnecting the Cuff for Adults and Children

To disconnect the cuff from the air hose, turn the cuff connector joint counterclockwise to unlock it and remove it from the air hose.

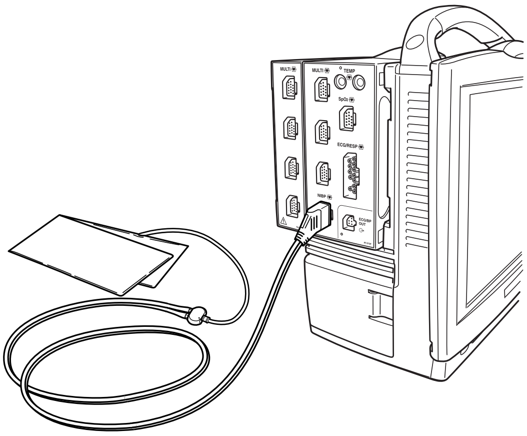




Connecting the Cuff for Neonates

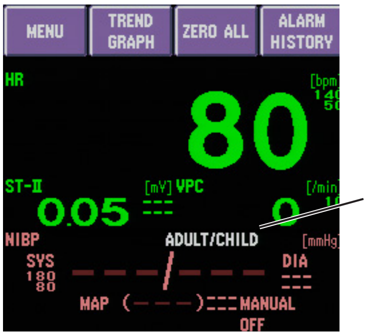
Insert the cuff connector into the air hose for neonate.

2. Connect the air hose to the NIBP socket on the unit. The monitor automatically identifies the type of the connected cuff (subject of measurement) and displays it on the home screen.


MULTI
MULTI
TEMP
SpO2
ECG/RESP
NIBP
ECG/BP OUT

When Connecting the YP-963P Cuff for Adults

3. Check that the home screen displays the correct cuff type.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
HR
[bpm]
80
ST-II
[mV]
0.05
VPC
[/min]
0
NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
DIA
MAP
MANUAL
OFF

Cuff type

Attaching the Cuff to the Patient

How to Wrap the Cuff

WARNING

Be careful when measuring NIBP on a patient with known bleeding disorders or coagulation. After NIBP measurement, there may be dot hemorrhage, or circulatory disorder by thrombus where the cuff is attached.

CAUTION

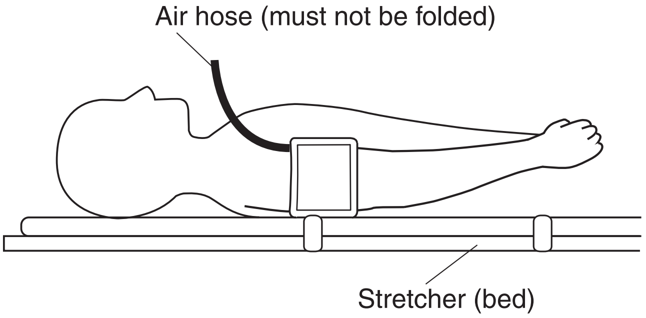
Do not wrap the cuff on an arm or thigh which is used for injection. NIBP measurement on an arm or thigh which is used for injection may cause reflux of blood and stop injection.

CAUTION

Do not wrap the cuff too tight. It may cause poor blood circulation and congestion. If the cuff is wrapped too loosely, the NIBP value may increase.

Wrap the cuff on the patient arm or thigh by referring to the manual provided with the cuff. When wrapping the cuff around the upper arm, observe the following points.

- The cuff must not wrap around the elbow.
- The cuff should just wrap around the upper arm, not too tightly or too loosely. A tightly wrapped cuff can cause discomfort to the patient and decreases the blood pressure reading, and a loosely wrapped cuff prolongs the measurement time and increases the blood pressure reading. If the cuff is too tight or too loose, the instrument may automatically stop inflating and stop the measuring procedure for patient safety.
- The air hose must not be folded.
- In principle, the cuff should be wrapped around a bare upper arm. Thick clothing can damp the pulsatile oscillation of the cuff pressure. It is still possible to obtain a measurement if the cuff is wrapped around thin clothing over the upper arm.



Cuff Hose and Air Hose

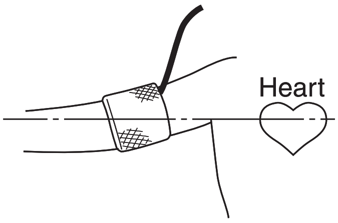
Confirm that the hoses are not folded or squeezed.

CAUTION

When too much pressure is applied to the cuff, or the hose is bent or squeezed, the “NIBP SAFETY CIRCUIT RUNNING” message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait 40 seconds, check that the message disappears, then measure again.

CAUTION

Only connect the air hose to the cuff and NIBP socket on the monitor. Do not connect the air hose, especially the air hose for neonate, to other parts, such as an infusion line. It may cause thrombus.



Cuff Position (Height of Cuff from Heart Level)

Place the cuffed upper arm (brachium) at the same height as the patient’s heart. If the cuff is not at the same level as the heart, the weight of the blood affects the blood pressure reading. The pressure difference per unit height is 0.7 mmHg/cm. The blood pressure reading decreases when the arm is higher than the heart and increases when lower.

The best measuring condition is when the patient is lying on his/her back with arms and legs relaxed. If the cuff position cannot be on the same level as the heart, the displayed blood pressure reading must be mathematically adjusted.

Measuring and Monitoring NIBP

When the preparation is done properly, you can start non-invasive blood pressure measurement and monitoring.

The monitor automatically identifies the connected cuff type and sets the cuff inflation pressure.

WARNING

When performing long term measurement at intervals less than 2.5 minutes, perform measurements while observing the state of the patient, blood vessels and limb to ensure adequate circulation. Congestion may occur at the measurement site. When performing periodic measurement for a long time, periodically check the circulation condition.

CAUTION

When too much pressure is applied to the cuff, or the hose is bent or squeezed, the "NIBP SAFETY CIRCUIT RUNNING" message appears on the screen and NIBP monitoring may be stopped. Remove the cause, wait 40 seconds, check that the message disappears, then measure again.

CAUTION

Before starting STAT or SIM mode measurement, check the measurement setting (measurement intervals).

NOTE

- When measuring patients who are conscious, help the patient to relax. Measurement may not be accurate if the patient's arm is tense or if the patient talks.
- The data for measurement on the thigh tends to be higher than measurement on the arm.
- Do not apply pressure to the cuff or air hose. NIBP might not be measured correctly because of the noise or NIBP measurement may stop due to the NIBP safety circuit running.
- Do not measure NIBP on a patient on whom an IABP is used. Accurate NIBP measurement cannot be performed due to pulse waves from the IABP mixing with the patient's pulse waves.

Measurement Mode and Interval

There are four NIBP measurement modes: manual, auto (periodic), STAT (continuous) and SIM. The SIM mode is only available in OR site and when SIM is set to ON on the SYSTEM SETUP window. To change the site and SIM setting, refer to the Administrator's Guide.

Manual Measurement

NIBP is measured once whenever the [NIBP Start/Stop] key on the monitor is pressed. Manual measurement cannot be performed during the first stage of the STAT or SIM mode measurement.

Auto Measurement

The first NIBP measurement is performed when the [NIBP Start/Stop] key on the monitor is pressed and auto mode on the home screen is highlighted. The second measurement is performed when the current time (minutes) in the monitor reaches the nearest time interval selected.

The second periodic measurement time begins from the next even clock interval.

Example: When the interval is set to 5 minutes

8:02	First measurement (start measurement)
8:05	Second measurement
8:10	Third measurement

If the measurement interval is changed during auto measurement, the next measurement is performed at the next nearest selected interval. For example, when the auto measurement is performed at 5 minute intervals and if the interval is changed to 30 minutes, then the measurement will be performed as follows. 9:05 (5 minute interval measurement), 9:07 (interval changed to 30 minutes), 9:30 (30 minute interval measurement), 10:00 (30 minute interval measurement) and so on.

NOTE

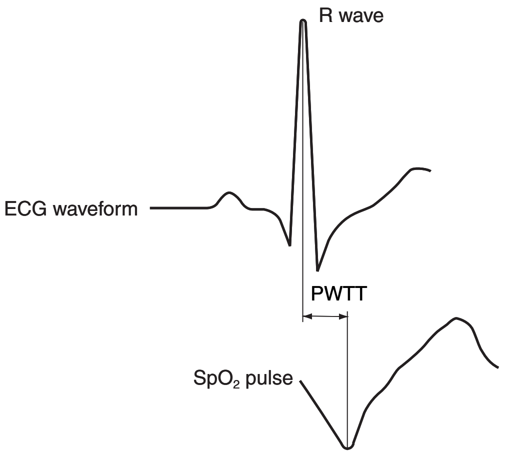
The NIBP measurement time of the NIBP list on the TREND-NIBP window is the time the measurement is completed.

Auto Measurement with PWTT

NOTE

- When using the AY-631P, AY-633P, AY-651P or AY-653P input unit, automatic measurement with PWTT is not available. PWTT is only available when using Nihon Kohden probe for monitoring SpO_2.
- When the SpO_2 measurement is performed using an SpO_2 probe connected to the MULTI socket on the AY-661P, AY-663P, AY-671P or AY-673P input unit, AA-672P or AA-674P smart expansion unit or JA-694PA data acquisition unit, automatic measurement with PWTT is not available.

When PWTT MEASUREMENT is set to ON and the trigger threshold is set on the PWTT page of the NIBP window, NIBP is automatically measured when the PWTT exceeds the threshold. Refer to the “Changing the PWTT Settings” section for changing PWTT settings.



PWTT (pulse wave transit time) is a parameter which can indicate sudden change in blood pressure. PWTT is the interval between the R wave of the ECG and the onset of the SpO_2 pulse wave. In many cases, PWTT changes according to change in circulation. This PWTT change (delta PWTT) can be used to trigger NIBP measurement. When the delta PWTT exceeds a preset threshold, it triggers NIBP measurement. Therefore, PWTT can be used to monitor sudden critical changes in blood pressure which may go undetected by the usual periodic NIBP measurement.

CAUTION

Do not rely only on the PWTT to monitor blood pressure changes. When it is necessary to monitor critical blood pressure change, set the appropriate interval for NIBP measurement.

CAUTION

- Do not measure NIBP with PWTT on a neonate because circulation of a neonate changes rapidly.
- In the following cases, PWTT may trigger too many or no NIBP measurements. Check the patient condition. If necessary, change the delta PWTT threshold or set the PWTT to OFF.
- Rapid blood pressure change with vasoreflex due to vasoactive drugs, such as phenylephrine and nicardipine
- Unstable pulse wave due to poor peripheral circulation
- Too many arrhythmias
- Patient movement
- Noise on ECG due to ESU
- SpO_2 measurement on foot of a child

To use PWTT in automatic NIBP measurement, you must set the <PWTT MEASUREMENT> to ON and the delta PWTT threshold on the PWTT page of the NIBP window. Refer to the “Changing the PWTT Settings” section.

NOTE

- NIBP measurement with PWTT can only be performed when the NIBP measurement mode is set to one of the intervals.
- NIBP measurement with PWTT is performed when ECG and SpO_2 are monitored. When ECG or SpO_2 is not monitored, delta PWTT appears blank on the home screen.
- When the delta PWTT threshold is too short for a patient, NIBP measurement may be performed too frequently. If this occurs, change the delta PWTT threshold to a longer time.
- The PWTT may be incorrect when there is too much arrhythmia or noise.
- NIBP is not measured within one minute of automatic NIBP measurement even if delta PWTT exceeds the threshold.

- When using PWTT for NIBP measurement during operation, set arrhythmia analysis on the ECG window to ON. If set to OFF, the PWTT may be incorrect due to ESU. To change the ECG setting, refer to Section 1.
- When changing the ECG lead, the baseline of PWTT is reset and PWTT may be discontinuous.

STAT Measurement

Measurements are performed continuously according to the measurement program set for STAT measurement on the SYSTEM SETUP window. The program is divided into two stages. In the first stage, NIBP is measured continuously or at 1 minute intervals for 5 or 10 minutes. In the second stage, NIBP is measured at a different interval (manual or 1, 2, 2.5, 5, 10, 15, 30 minutes, usually, longer interval than the first stage). Manual measurement cannot be performed during first stage measurement. The settings on the SYSTEM SETUP window can only be set by an administrator who has the password to enter the page.

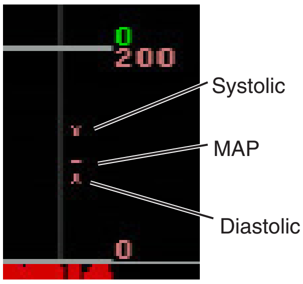
SIM Mode Measurement

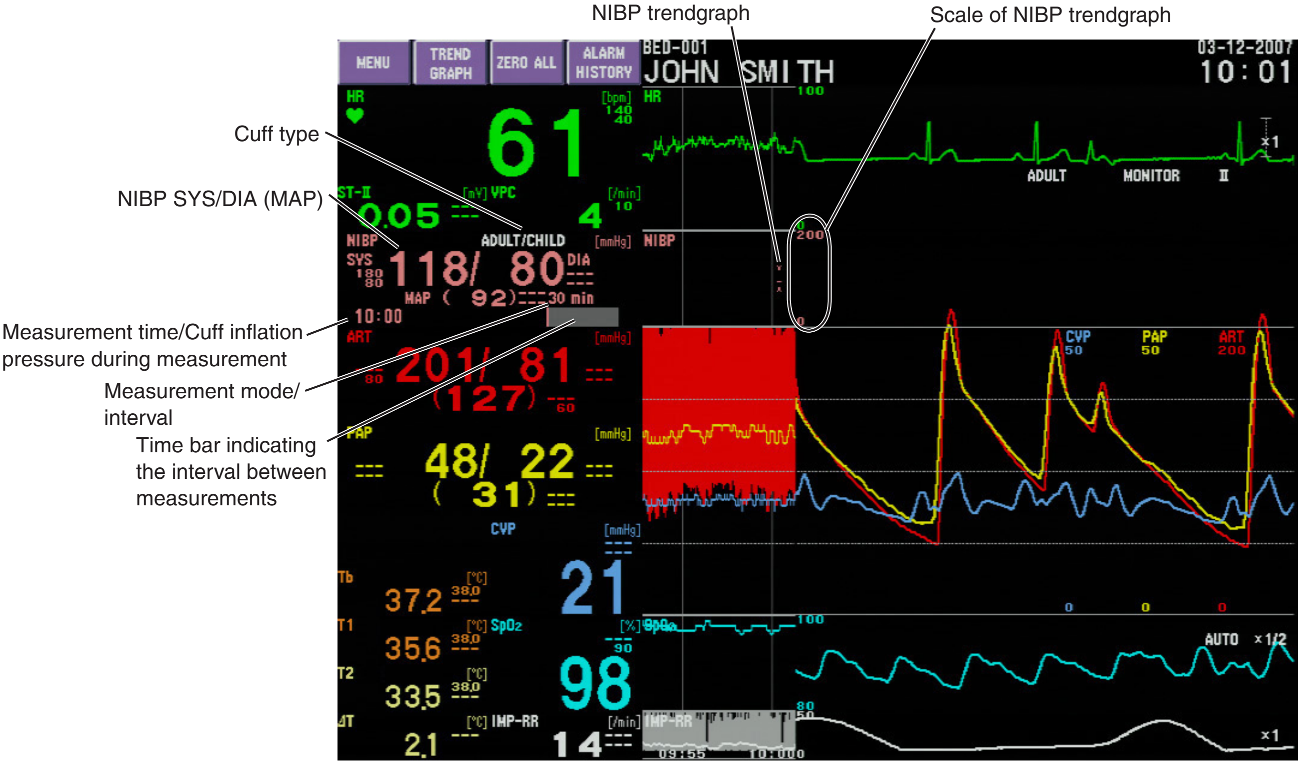
SIM mode program is for monitoring blood pressure during regional anesthesia, such as lumbar block, subarachnoid block and epidual anesthesia.

Measurements are performed continuously according to the measurement program set for SIM measurement on the SYSTEM SETUP window. The program is divided into two stages. In the first stage, NIBP is measured at 1, 2 or 2.5 minute intervals for 5, 10 or 15 minutes. In the second stage, NIBP is measured at a different interval (2, 2.5 or 5 minutes, usually a longer interval than the first stage). Manual measurement cannot be performed during first stage measurement. The settings on the SYSTEM SETUP window can only be set by an administrator who has the password to enter the page.

The SIM mode is only available in OR site and when SIM is set to ON on the SYSTEM SETUP window. To change the site and SIM setting, refer to the Administrator’s Guide.

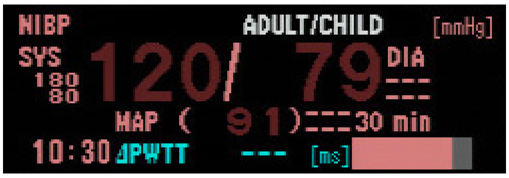
NIBP Information on the Home Screen


0
200
Systolic
MAP
Diastolic
0


NIBP trendgraph
Scale of NIBP trendgraph
Cuff type
NIBP SYS/DIA (MAP)
Measurement time/Cuff inflation pressure during measurement
Measurement mode/ interval
Time bar indicating the interval between measurements
MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
03-12-2007
10:01
HR
61
ST-II
0.05
VPC
4
NIBP
ADULT/CHILD
SYS
118/ 80
DIA
MAP (92)
30 min
10:00
ART
201/ 81
(127)
PAP
48/ 22
(31)
CVP
21
Tb
37.2
T1
35.6
T2
33.5
ΔT
2.1
SpO2
98
IMP-RR
14
ADULT
MONITOR
II
CVP
PAP
ART
AUTO
09:55
10:00

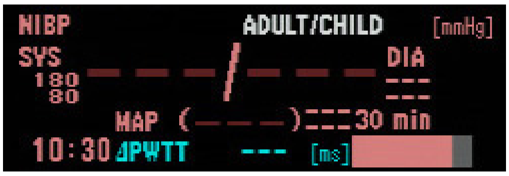
Dimming and Hiding the NIBP Data

When the time set at <TIME UNTIL DATA IS OLD> on the SYSTEM SETUP window elapses after the last measurement, the NIBP data on the home screen is dimmed or hidden. Whether to dim or hide the old data can be selected at <OLD DATA DISPLAY> on the SYSTEM SETUP window. To change the SYSTEM SETUP settings, refer to Section 3 of the Administrator’s Guide.


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
120/ 79
DIA
MAP (91)
30 min
10:30
ΔPWTT

[ms]

Setting: DIM


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
---/---
DIA
MAP (---)
30 min
10:30
ΔPWTT

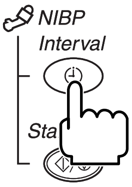
[ms]

Setting: HIDE

Performing NIBP Measurement

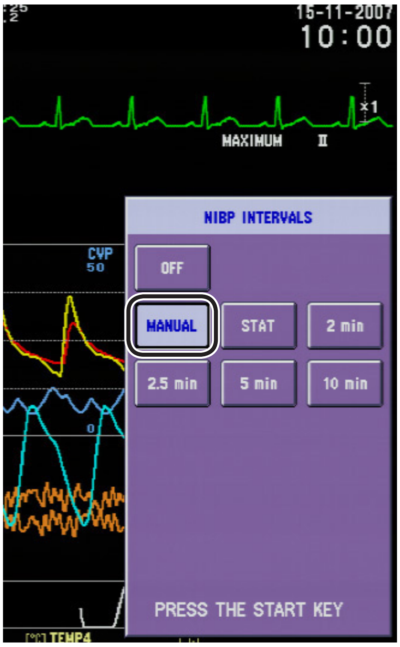
NOTE

- After NIBP measurement, the next measurement cannot start until the cuff pressure is less than 10 mmHg (2 mmHg in the Neonate mode) for more than 3 seconds.
- When NIBP START/STOP key is assigned to the function key, the NIBP measurement can also be performed with the function key. For details on the function keys, refer to Section 3 of the Administrator's Guide.


NIBP
Interval
Sta

Manual Measurement

1. Press the [NIBP Interval] key to open the NIBP INTERVALS window to change the interval to “MANUAL”.

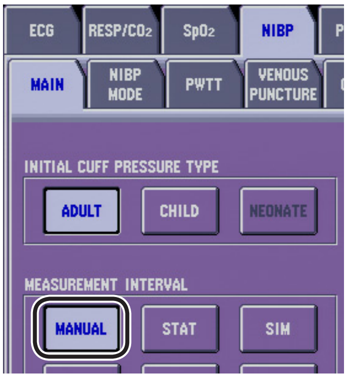

15-11-2007
10:00
×1
MAXIMUM
II
NIBP INTERVALS
CVP
50
OFF
MANUAL
STAT
2 min
2.5 min
5 min
10 min
0
TEMP4

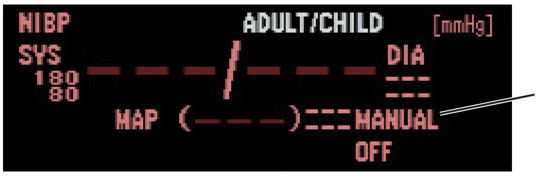
PRESS THE START KEY

The measurement modes displayed on the NIBP INTERVALS window are selected on the SYSTEM SETUP window. Refer to the Administrator's Guide.

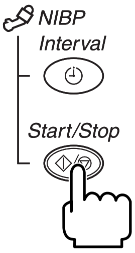
Or,

Touch MANUAL in the <MEASUREMENT INTERVAL> box on the MAIN page of the NIBP window.

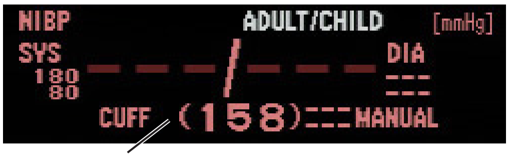

ECG
RESP/CO2
SpO2
NIBP
MAIN
NIBP MODE
PWTT
VENOUS PUNCTURE
INITIAL CUFF PRESSURE TYPE
ADULT
CHILD
NEONATE
MEASUREMENT INTERVAL
MANUAL
STAT
SIM


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
DIA
MAP
MANUAL
OFF

Measurement mode “MANUAL”


NIBP
Interval
Start/Stop

2. Press the [NIBP Start/Stop] key to start measurement. During measurement, the cuff inflation pressure appears.


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
DIA
CUFF
(158)
MANUAL

Cuff inflation pressure

When measurement is complete, the measured data appears on the screen.

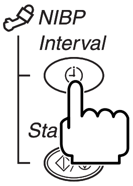
When <COMPLETION SOUND> in the SYSTEM SETUP window is set to On, a “peep” sounds is generated when NIBP measurement is complete. For details on the completion sound, refer to Section 3 of the Administrator’s Guide.

To stop measurement during measurement, press the [NIBP Start/Stop] key.

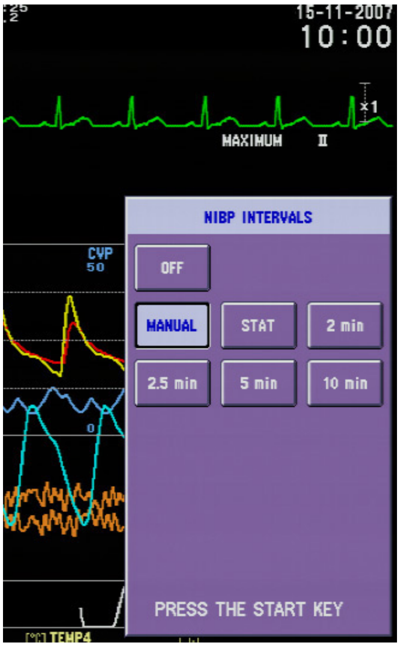
Auto Measurement

WARNING

When performing long term measurement at intervals less than 2.5 minutes, perform measurements while observing the state of the patient, blood vessels and limb to ensure adequate circulation. Congestion may occur at the measurement site. When performing periodic measurement for a long time, periodically check the circulation condition.

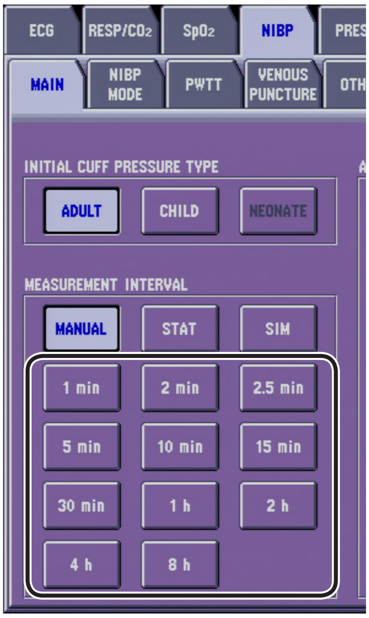

NIBP
Interval
Sta

1. Press the [NIBP Interval] key to open the NIBP INTERVALS window to select the interval.


15-11-2007
10:00
x1
MAXIMUM
II
CVP
50
0
NIBP INTERVALS
OFF
MANUAL
STAT
2 min
2.5 min
5 min
10 min
TEMP4

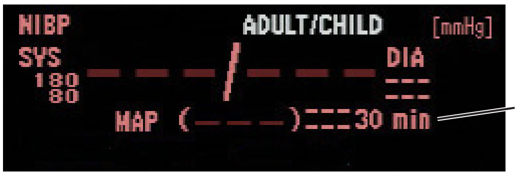
PRESS THE START KEY

The measurement modes displayed on the NIBP INTERVALS window are selected on the SYSTEM SETUP window. Refer to the Administrator’s Guide.


ECG
RESP/CO2
SpO2
NIBP
PRES
MAIN
NIBP MODE
PWTT
VENOUS PUNCTURE
OTH
INITIAL CUFF PRESSURE TYPE
ADULT
CHILD
NEONATE
MEASUREMENT INTERVAL
MANUAL
STAT
SIM
1 min
2 min
2.5 min
5 min
10 min
15 min
30 min
1 h
2 h
4 h
8 h

Or,

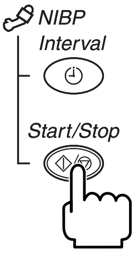
Select the interval from the <MEASUREMENT INTERVAL> box on the MAIN page of the NIBP window.


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
DIA
MAP
30 min

Measurement interval

NOTE

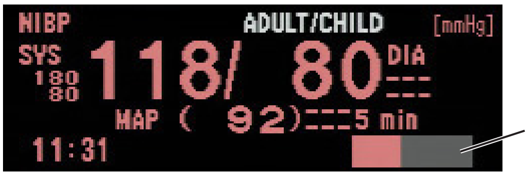
When <NIBP INTERVAL KEY STARTS NIBP> on the SYSTEM SETUP window is set to ON, the first measurement starts when the interval is selected by pressing the [NIBP Interval] key on the monitor. To change the SYSTEM SETUP settings, refer to the Administrator's Guide.



2. Press the [NIBP Start/Stop] key to start measurement. During measurement, the cuff inflation pressure appears.

   If the auto mode is not highlighted on the home screen, it means that the auto measurement is not yet started.

   When measurement is complete, the measured data appears on the screen.



Time bar indicating the interval between measurements

   When <COMPLETION SOUND> in the SYSTEM SETUP window is set to On, a "bong" sounds is generated when NIBP measurement is complete. For details on the completion sound, refer to Section 3 of the Administrator's Guide.

3. When the interval elapses, the second measurement automatically starts.

To stop one measurement in auto mode, press the [NIBP Start/Stop] key. To stop auto measurement, change the measurement mode to "MANUAL".

To perform a manual measurement in this mode, press the [NIBP Start/Stop] key between auto measurements.

If the measurement interval is changed during auto measurement, the next measurement is performed at the next nearest selected interval.

Auto Measurement with PWTT

NOTE

- When using the AY-631P, AY-633P, AY-651P or AY-653P input unit, automatic measurement with PWTT is not available. PWTT is only available when using Nihon Kohden probe for monitoring SpO$_2$.
- When the SpO$_2$ measurement is performed using an SpO$_2$ probe connected to the MULTI socket on the AY-661P, AY-663P, AY-671P or AY-673P input unit, AA-672P or AA-674P smart expansion unit or JA-694PA data acquisition unit, automatic measurement with PWTT is not available.

Auto measurement with PWTT procedure is the same as the auto measurement. When <PWTT MEASUREMENT> is set to ON and trigger threshold is set on the PWTT page of the NIBP window, NIBP is automatically measured when the PWTT exceeds the threshold. PWTT trendgraph can be displayed on the home screen. Refer to the “Changing the PWTT Settings” section for changing PWTT settings and to the Operator’s Manual or Section 4 of the User’s Guide Part I for displaying PWTT trendgraph on the home screen.

STAT Measurement

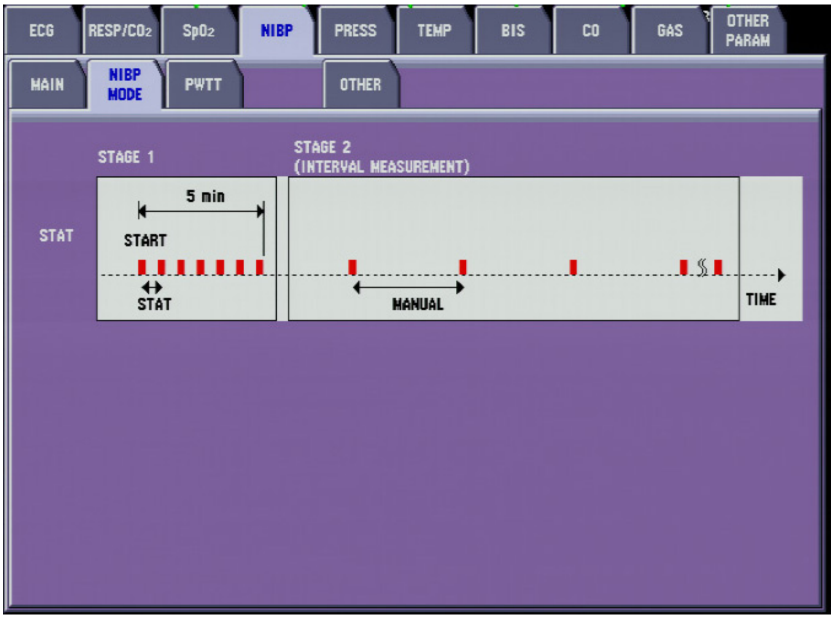
WARNING

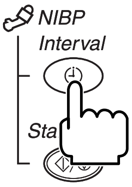
When performing long term measurement at intervals less than 2.5 minutes, perform measurements while observing the state of the patient, blood vessels and limb to ensure adequate circulation. Congestion may occur at the measurement site. When performing periodic measurement for a long time, periodically check the circulation condition.

CAUTION

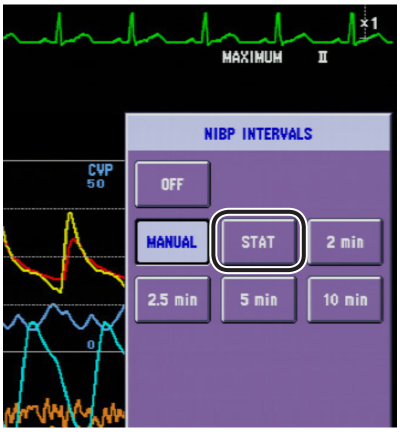
Before starting STAT or SIM mode measurement, check the measurement setting (measurement intervals).

1. Before STAT measurement, check the measurement setting on the NIBP MODE page of the NIBP window.
   Press [Menu] key → NIBP key → NIBP MODE tab.

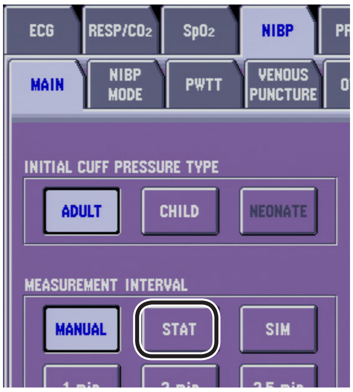

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
NIBP MODE
PWTT
OTHER
STAGE 1
STAGE 2 (INTERVAL MEASUREMENT)
STAT
5 min
START
STAT
MANUAL
TIME


NIBP
Interval
Sta

2. Press the [NIBP Interval] key to open the NIBP INTERVALS window to change the interval to “STAT”.

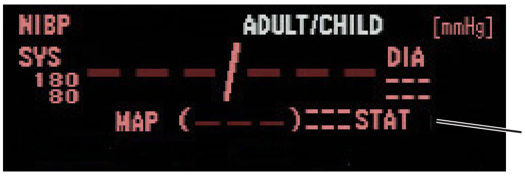

×1
MAXIMUM II
CVP
50
0
NIBP INTERVALS
OFF
MANUAL
STAT
2 min
2.5 min
5 min
10 min

The measurement modes displayed on the NIBP INTERVALS window are selected on the SYSTEM SETUP window. Refer to the Administrator’s Guide.

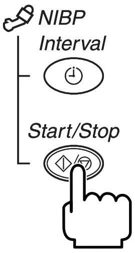

ECG
RESP/CO2
SpO2
NIBP
MAIN
NIBP MODE
PWTT
VENOUS PUNCTURE
INITIAL CUFF PRESSURE TYPE
ADULT
CHILD
NEONATE
MEASUREMENT INTERVAL
MANUAL
STAT
SIM

Or,

Select STAT from the <MEASUREMENT INTERVAL> box on the MAIN page of the NIBP window.


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
DIA
MAP
STAT

Measurement mode “STAT”


NIBP
Interval
Start/Stop

3. Press the [NIBP Start/Stop] key to start measurement in the first stage. During measurement, the cuff inflation pressure appears.

   When measurement is complete, the measured data appears on the screen and another measurement starts.

   When <COMPLETION SOUND> in the SYSTEM SETUP window is set to On, a “bong” sounds is generated when NIBP measurement is complete. For details on the completion sound, refer to Section 3 of the Administrator’s Guide.

   Manual measurement is not available during the first stage of STAT measurement.

4. When the first stage is completed, measurement in the second stage starts.

To stop STAT measurement in the first stage, press the [NIBP Start/Stop] key.

To stop STAT measurement in the second stage, change the measurement mode to “MANUAL”.

To perform a manual measurement between auto measurements, press the [NIBP Start/Stop] key.

SIM Mode Measurement

WARNING

When performing long term measurement at intervals less than 2.5 minutes, perform measurements while observing the state of the patient, blood vessels and limb to ensure adequate circulation. Congestion may occur at the measurement site. When performing periodic measurement for a long time, periodically check the circulation condition.

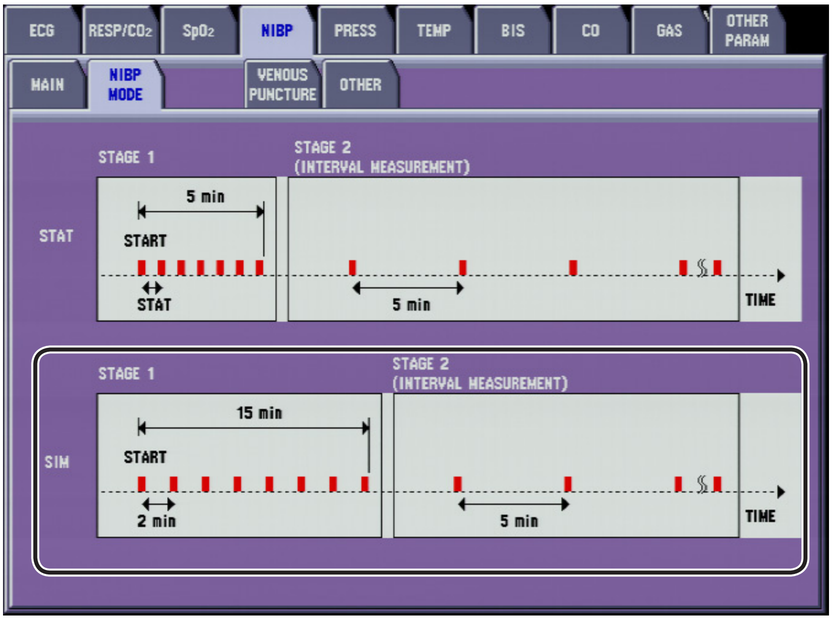
CAUTION

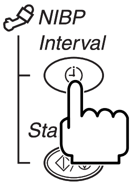
Before starting STAT or SIM mode measurement, check the measurement setting (measurement intervals).

NOTE

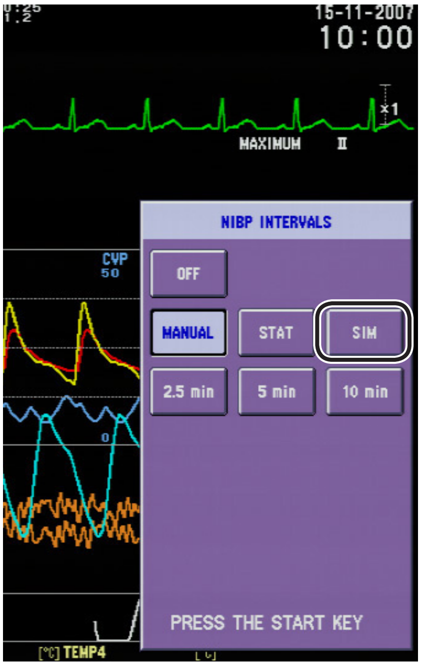
The SIM mode is only available in the OR site and when SIM is set to ON on the SYSTEM SETUP window. To change the site and SIM setting, refer to the Administrator's Guide.

1. Before SIM measurement, check the measurement setting on the NIBP MODE page of the NIBP window.
   Press [Menu] key → NIBP key → NIBP MODE tab.

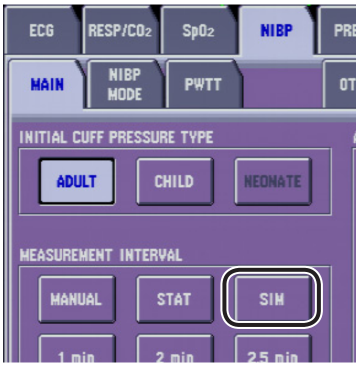

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
NIBP MODE
VENOUS PUNCTURE
OTHER
STAT
STAGE 1
STAGE 2 (INTERVAL MEASUREMENT)
5 min
START
STAT
5 min
TIME
SIM
STAGE 1
STAGE 2 (INTERVAL MEASUREMENT)
15 min
START
2 min
5 min
TIME


NIBP Interval
Sta

2. Press the [NIBP Interval] key to open the NIBP INTERVALS window to change the interval to "SIM".

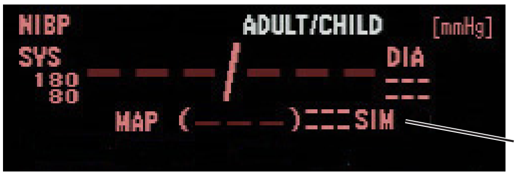

15-11-2007
10:00
x1
MAXIMUM II
CVP 50
0
NIBP INTERVALS
OFF
MANUAL
STAT
SIM
2.5 min
5 min
10 min
PRESS THE START KEY
[°C] TEMP4

The measurement modes displayed on the NIBP INTERVALS window are selected on the SYSTEM SETUP window. Refer to the Administrator's Guide.

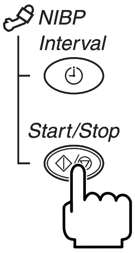

ECG
RESP/CO2
SpO2
NIBP
MAIN
NIBP MODE
PWTT
INITIAL CUFF PRESSURE TYPE
ADULT
CHILD
NEONATE
MEASUREMENT INTERVAL
MANUAL
STAT
SIM
1 min
2 min
2.5 min

Or,

Select SIM from the <MEASUREMENT INTERVAL> box on the MAIN page of the NIBP window.


NIBP
ADULT/CHILD
[mmHg]
SYS
180
80
DIA
MAP
SIM

Measurement mode "SIM"


NIBP
Interval
Start/Stop

3. Press the [NIBP Start/Stop] key to start measurement in the first stage. During measurement, the cuff inflation pressure appears.

   When measurement is complete, the measured data appears on the screen and another measurement starts.

   When <COMPLETION SOUND> in the SYSTEM SETUP window is set to On, a "bong" sounds is generated when NIBP measurement is complete. For details on the completion sound, refer to Section 3 of the Administrator's Guide.

   Manual measurement is not available during the first stage of SIM mode measurement.

4. When the first stage is completed, measurement in the second stage starts.

To stop SIM measurement in the first stage, press the [NIBP Start/Stop] key.

To stop SIM measurement in the second stage, change the measurement mode to “MANUAL”.

To perform a manual measurement between auto measurements, press the [NIBP Start/Stop] key.

Changing NIBP Settings

Change settings on the NIBP window. The following settings can be changed for monitoring NIBP.

- Initial cuff inflation pressure
- Measurement mode and interval
- NIBP alarm limits
- Automatic measurement with PWTT on/off and trigger threshold

The following items can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

- Measurement end sound on or off
- Starting NIBP auto measurement by pressing the [NIBP Interval] key
- SIM mode measurement on or off
- Measurement mode after the monitor power is off for more than 30 minutes (when the AUTO ADMIT is set to On) or the monitor is initialized
- Dim or hide the old measurement data
- Time after NIBP measurement for the NIBP data to be dimmed or hidden
- Measurement program for STAT and SIM modes
- Measurement interval displayed on the NIBP INTERVALS window when the [NIBP Interval] key is pressed
- Venous puncture mode on or off and cuff inflation pressure for venous puncture
- NIBP data display color

The NIBP unit (mmHg or kPa) is the same as the pressure unit. The pressure unit is set on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.

The scale of the NIBP trendgraph on the home screen is the same scale as the trendgraph of the Review window. Refer to Operator's Manual or Section 6 of the User's Guide Part I.

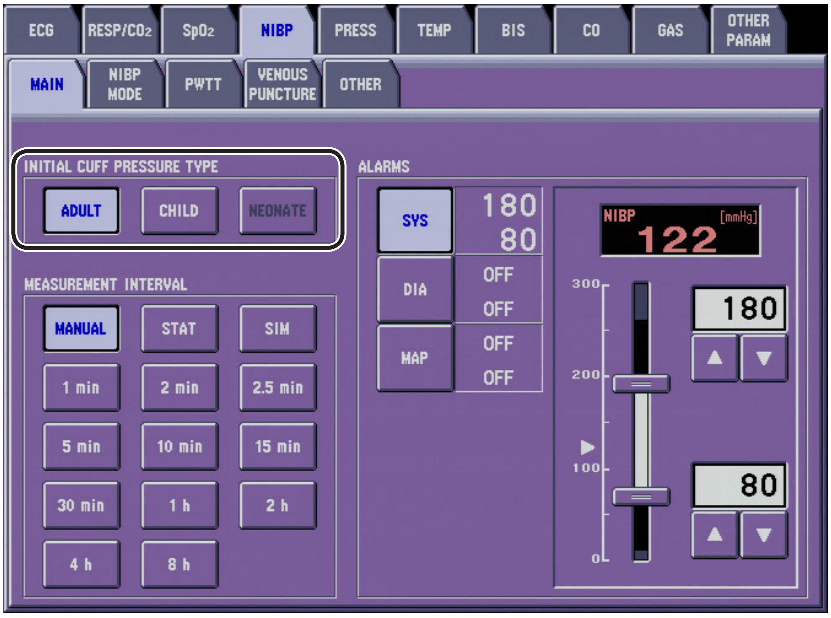
Selecting the Initial Cuff Inflation Pressure

Selecting the Initial Cuff Inflation Pressure Type

When the air hose for adult/child is connected to the NIBP socket, select the initial cuff inflation pressure type. When the air hose for neonate is connected, the initial cuff inflation pressure type is automatically set for neonate.

1. Display the MAIN page of the NIBP window.
   Press [Menu] key → NIBP key → MAIN tab.

2. Select the patient type in the <INITIAL CUFF PRESSURE TYPE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
NIBP MODE
PWTT
VENOUS PUNCTURE
OTHER
INITIAL CUFF PRESSURE TYPE
ADULT
CHILD
NEONATE
MEASUREMENT INTERVAL
MANUAL
STAT
SIM
1 min
2 min
2.5 min
5 min
10 min
15 min
30 min
1 h
2 h
4 h
8 h
ALARMS
SYS
180
80
DIA
OFF
OFF
MAP
OFF
OFF
NIBP
[mmHg]
122
300
200
100
0
180
80

3. Press the [Home] key to return to the home screen.

Setting the Cuff Inflation Pressure

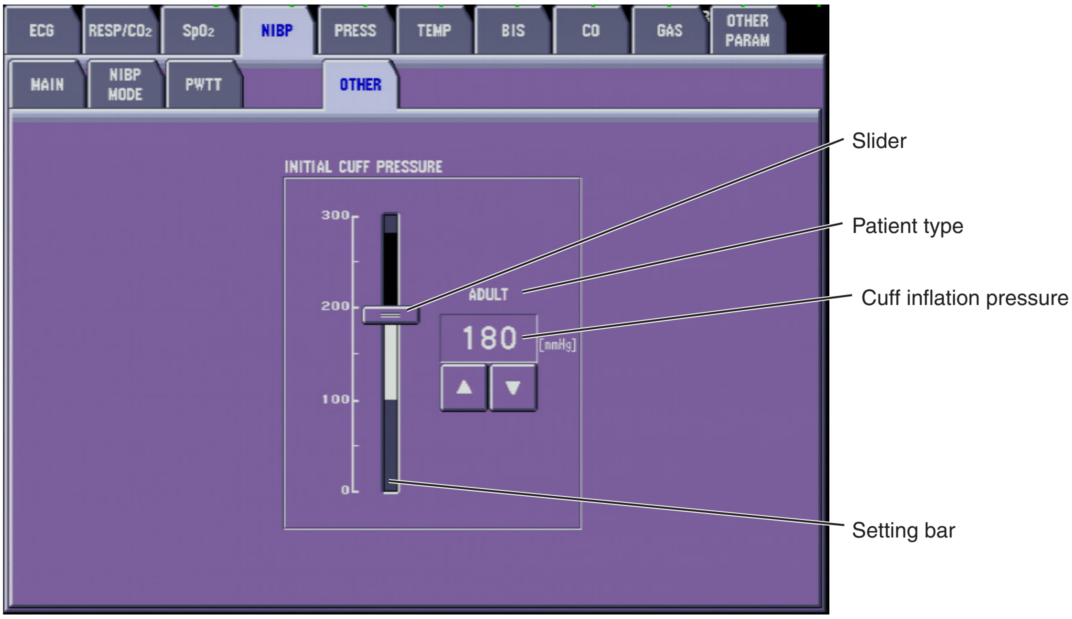
Select the cuff inflation pressure for the first measurement. After the first measurement, the cuff inflation pressure is the systolic value of the previous measurement plus 30 mmHg.

To change the initial cuff inflation pressure for neonate, the air hose for neonate must be connected to the NIBP socket on the unit.

Patient Type	Setting Range (5 mmHg/step, 1 kPa/step)	Default Setting
ADULT	100 to 280 mmHg, 13.0 to 37.0 kPa	180 mmHg, 24.0 kPa
CHILD	100 to 280 mmHg, 13.0 to 37.0 kPa	140 mmHg, 19.0 kPa
NEONATE	70 to 120 mmHg, 9.0 to 16.0 kPa	100 mmHg, 13.0 kPa

1. Select the patient type on the MAIN page. Refer to the previous procedure.

2. Display the OTHER page of the NIBP window.
   Press [Menu] key → NIBP key → OTHER tab.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
NIBP MODE
PWTT
OTHER
INITIAL CUFF PRESSURE
300
200
100
0
ADULT
180
[mmHg]
▲
▼
Slider
Patient type
Cuff inflation pressure
Setting bar

3. Touch and drag the slider to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

4. Press the [Home] key to return to the home screen.

Changing the NIBP Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower systolic, diastolic and MAP NIBP alarm limits on the NIBP window. You can set all alarms, including the upper and lower NIBP alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

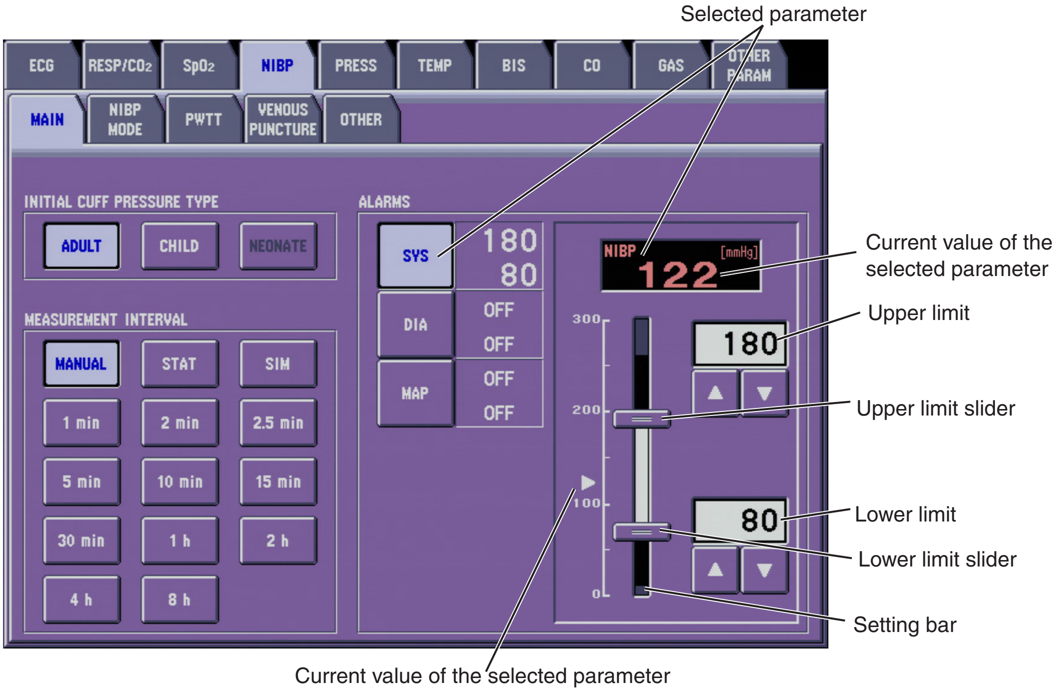
Setting Range

Upper limit: 15 to 260 mmHg in 5 mmHg steps (1.5 to 35.0 kPa in 0.5 kPa steps), OFF (default setting: Systolic: OR/ICU-180 mmHg (24.0 kPa), NICU-100 mmHg (13.5 kPa), Diastolic: OFF, MAP: OFF)

Lower limit: OFF, 10 to 255 in 5 mmHg steps (1.0 to 34.5 kPa in 0.5 kPa steps) (default setting: Systolic: OR/ICU-80 mmHg (10.5 kPa), NICU-50 mmHg (6.5 kPa), Diastolic: OFF, MAP: OFF)

1. Display the MAIN page of the NIBP window.
   Press [Menu] key → NIBP key → MAIN tab.

2. Touch the SYS key to change the systolic alarm setting.
   Touch the DIA key to change the diastolic alarm setting.
   Touch the MAP key to change the mean alarm setting.


Selected parameter
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
NIBP MODE
PWTT
VENOUS PUNCTURE
OTHER
INITIAL CUFF PRESSURE TYPE
ADULT
CHILD
NEONATE
MEASUREMENT INTERVAL
MANUAL
STAT
SIM
1 min
2 min
2.5 min
5 min
10 min
15 min
30 min
1 h
2 h
4 h
8 h
ALARMS
SYS
180
80
DIA
OFF
OFF
MAP
OFF
OFF
NIBP
[mmHg]
122
300
200
100
0
180
80
Current value of the selected parameter
Upper limit
Upper limit slider
Lower limit
Lower limit slider
Setting bar
Current value of the selected parameter

3. Touch and drag the slider to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Changing the PWTT Settings

NOTE

- When using the AY-631P, AY-633P, AY-651P or AY-653P input unit, automatic measurement with PWTT is not available. PWTT is only available when using Nihon Kohden probe for monitoring SpO_2.
- When the SpO_2 measurement is performed using an SpO_2 probe connected to the MULTI socket on the AY-661P, AY-663P, AY-671P or AY-673P input unit, AA-672P or AA-674P smart expansion unit or JA-694PA data acquisition unit, automatic measurement with PWTT is not available.

You can select automatic NIBP measurement with or without PWTT. When PWTT is set to on, you can also select the delta PWTT threshold for triggering NIBP measurement.

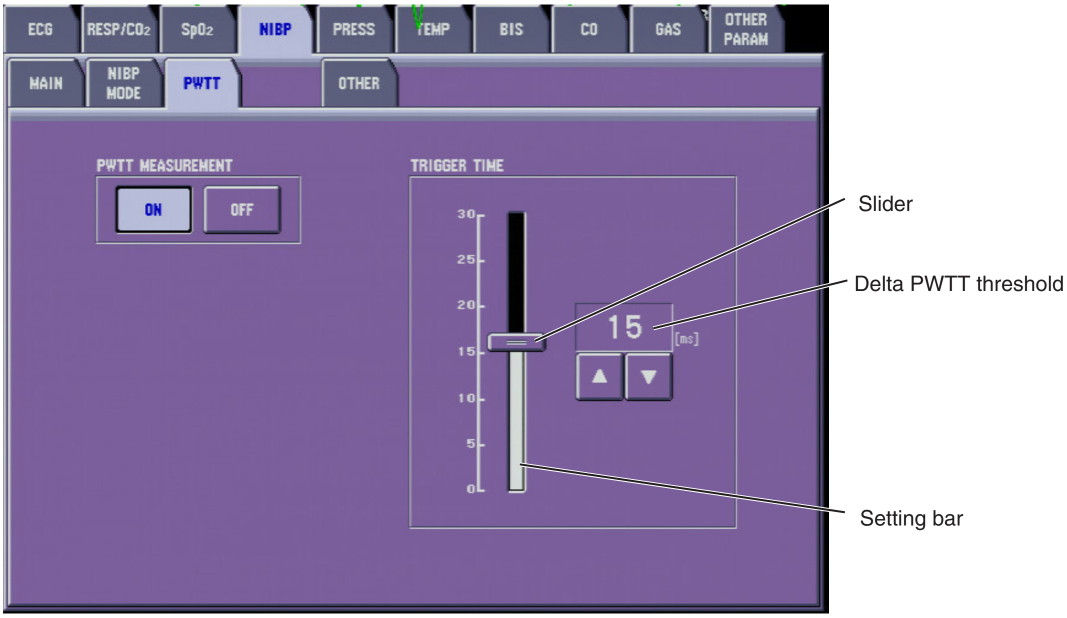
To trigger NIBP measurement with a smaller change in blood pressure, set the delta PWTT threshold to a shorter time.

If NIBP measurement is performed too frequently, set the delta PWTT threshold to a longer time.

1. Display the PWTT page of the NIBP window.
   Press [Menu] key → NIBP key → PWTT tab.

2. Touch the ON or OFF key in the <PWTT MEASUREMENT> box to turn auto measurement with PWTT on or off.

   When set to ON, select the delta PWTT threshold (in ms). Touch and drag the slider to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
NIBP MODE
PWTT
OTHER
PWTT MEASUREMENT
ON
OFF
TRIGGER TIME
30
25
20
15
10
5
0
15
[ms]
▲
▼
Slider
Delta PWTT threshold
Setting bar

3. Press the [Home] key to return to the home screen.

Using Venous Puncture Mode

To aid in inserting a venous line, you can use venous puncture mode to inflate the cuff to a preset pressure in order to prevent venous backflow. Venous backflow causes swelling of the veins and makes it difficult to insert a venous line.

In venous puncture mode, the cuff automatically deflates 2 minutes after inflation in ADULT/CHILD mode or 70 seconds after inflation in NEONATE mode. The cuff can also be deflated by the operator at any time.

To use venous puncture mode, venous puncture mode must be set to ON and the target cuff pressure must be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

CAUTION

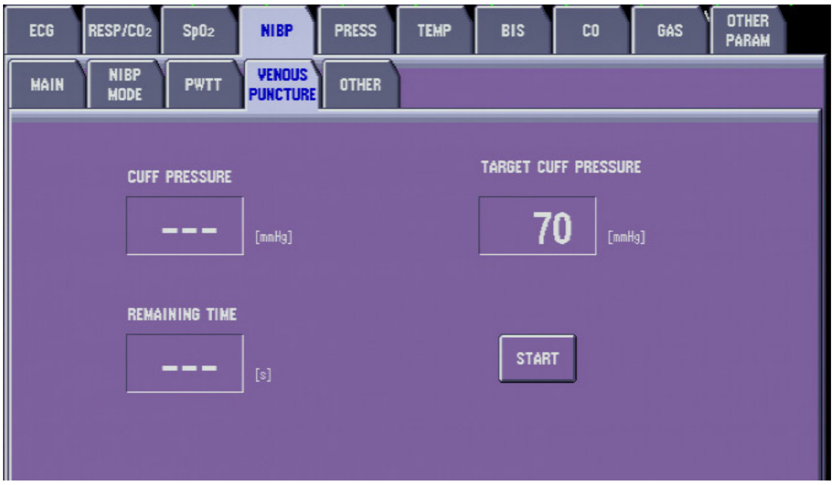
Do not perform a venous puncture on the same arm where NIBP is measured. This may cause an infusion backflow or internal hemorrhage at the puncture.

NOTE

Venous puncture mode is available in the following modes:

- Manual measurement mode
- STAT (continuous) measurement mode (not available during measurement)
- Auto (periodic) measurement mode (not available during measurement and not available when waiting for next measurement)
- SIM measurement mode (Not available during measurement and not available when waiting for next measurement)

1. Display the VENOUS PUNCTURE page of the NIBP window.
   Press [Menu] key → NIBP key → VENOUS PUNCTURE tab.



TARGET CUFF PRESSURE 70 [mmHg]

2. Touch the START key on the VENOUS PUNCTURE window. The cuff starts inflating and the remaining time until cuff deflation is shown in the <REMAINING TIME> box.

The cuff inflation can be stopped at any time by touching the STOP key on the VENOUS PUNCTURE window or by displaying another window.

3. Press the [Home] key to return to the home screen.

Section 6 IBP Monitoring

General 6.2
Preparing for Blood Pressure Monitoring 6.4
    Preparation Flowchart 6.4
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        Blood Pressure Transducers 6.5
        IBP Connection Cords 6.6
        JP-940P IBP Connection Box 6.6
    Installing the Blood Pressure Measuring Device 6.7
        Connecting Cables to the Unit 6.7
        Assembling the Transducer 6.8
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        Memorizing the Zero Balance Values 6.12
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    Changing the Label 6.16
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    Changing PPV or SPV Average Time 6.27

General

Invasive blood pressure and intracranial pressure (ICP) are measured and monitored by connecting the blood pressure measuring device to the units. Up to 7 channels can be measured (1 socket, 1 channel).

Using the Output Signal from the ECG/BP OUT Socket

CAUTION

When using the output signal from the monitor as the synchronization signal for other equipment such as an IABP (intra-aortic balloon pump) or defibrillator:

- Set the timing of the IABP by checking the waveform on the IABP screen.
- Check the condition of the bedside monitor at all times. The output signal may become unstable.
- Check that the delay time of the output signal is within the range of the connected equipment.

CAUTION

Only a Nihon Kohden defibrillator can use the output signal from the monitor as a synchronization signal. Check that the delay time of the output signal (heart rate trigger 20 ms maximum) is within the range of the connected defibrillator.

NOTE

- When using an IBP waveform as a synchronization signal for other equipment, connect the IBP line to the MULTI socket on the input unit. The IBP waveform that is used for the synchronization signal depends on the “IBP ANALOG OUT” setting in the SYSTEM SETUP window.
  - When “IBP ANALOG OUT” is set to “FIXED POSITION”: The IBP line connected to the top MULTI socket on the input unit is used.
  - When “IBP ANALOG OUT” is set to “HIGHEST PRIORITY LABEL”: When more than one IBP waveform is acquired, the IBP waveform of the highest priority label is used.
    IBP label priority:
    ART > ART2 > RAD > DORS > AO > FEM > UA > LVP > P1 > P2 > P3 > P4 > P5 > P6 > P7
- Analog ECG, analog BP and heart rate trigger output are not available when an AY-660P input unit is used.
- The output signal from the ECG/BP OUT socket may become unstable in the following conditions.
  - Electrode is dry or detached.
  - Electrode lead is damaged or disconnected from the electrode.
  - Electrode lead is pulled.
  - AC interference or EMG noise superimposed.
  - Air bubbles or blood clog in the circuit for monitoring IBP.
  - Cord or cable is disconnected or damaged.
- All instruments which are to be connected to the ECG/BP OUTPUT socket must use a YJ-910P or YJ-920P ECG/BP output cable and comply with the IEC 60601-1 safety standard for medical equipment.

The following shows the delay time of the output signal.

Output Signal	Delay Time
ECG	20 ms
BP	40 ms
Heart rate trigger	20 ms

Preparing for Blood Pressure Monitoring

Preparation Flowchart

NOTE

When using the JA-690PA or JA-694PA data acquisition unit, the MULTI sockets on the data acquisition unit cannot be used for IBP output. Use the MULTI sockets on the input unit or smart expansion unit.

1. Select the blood pressure measuring device.

2. Install the blood pressure measuring device, connect the blood pressure transducer to the IBP connection cord, and connect the IBP connection cord to the MULTI socket on the unit. For details, refer to the instruction manual provided with the blood pressure transducer and measuring kit.

3. Insert the catheter into the patient.

4. Perform zero balance adjustment.

5. Change necessary settings.

6. Start measurement (Start monitoring).
   After zero balance adjustment, you can start IBP measurement and monitoring.

Selecting the Blood Pressure Measuring Device

Select the appropriate blood pressure measuring device according to the purpose.

WARNING

All parts, except for transducers, must be non conductive. Otherwise, the discharged energy may cause electrical shock to the operator during defibrillation.

CAUTION

Do not reuse disposable parts and accessories.

Blood Pressure Transducers

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Becton Dickinson Reusable Blood Pressure Transducers

Pressure Transducer	IBP Connection Cord	Measuring Kit		Other Parts	Dome	Fixing Device
		Monitoring Kit	Pressure Tubing	Criti Flo		Transducer Holder
P23XL-1	JP-900P	SCK-520*	PT-06 PT-12 PT-24 PT-36 PT-48 PT-60	TA-4004 TA-4005*	TA-1011* TA-1011D* TA-1015T TA-1010ND	ZY-101U* + adapter 2
P10EZ-1	JP-900P	SCK-512* SCK-560			TA-1017M TA-1019M TA-1017 TA-1018* TA-1019*	G-TBG2 G-TMM G-UMM

Becton Dickinson Disposable Blood Pressure Transducers (DX Series)

Monitoring Kit DX Series	IBP Connection Cord	Other Parts	Fixing Device
DX-100*	JP-900P	—	G-TBG2 G-TMM G-UMM
DX-200*			
DX-300*			
DX-312*			
DX-360*			
DX-360R*			
DX-360TT*			
DX-360SD*		Safe needle TA-BPN + arterial blood sampler QS-90	
SCKD-5005*		—	

Edwards Lifesciences (Baxter) Disposable Blood Pressure Transducers (TruWave)

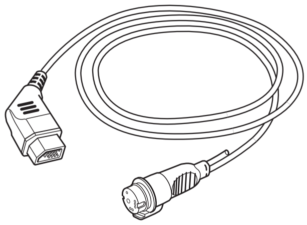
Edwards Lifesciences (Baxter) blood pressure transducers are available direct from Edwards Lifesciences (Baxter) (www.edwards.com) or their suppliers.

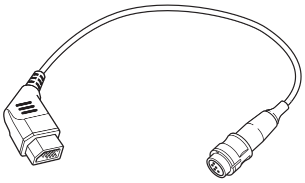
Monitor Kit	IBP Connection Cord	Fixing Device
MN12030US (TW)*	JP-920P	59-UH4 59-DTS-C
MN12030UW (TW)*		
MN12030UT (TW)*		
MP-5100 (TW)*		
MP-5200 (TW)*		

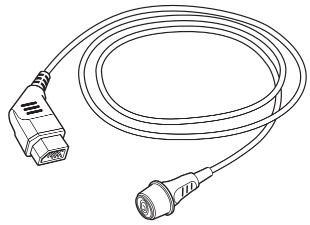
IBP Connection Cords

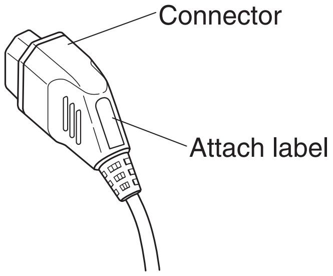
The IBP connection cord connector has a memory chip for saving site label and zero balance adjustment values. Attach the blood pressure site label of the saved site.

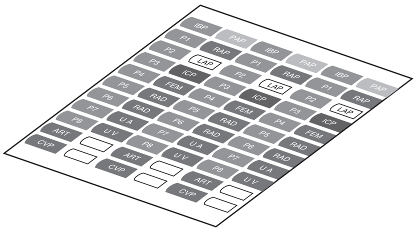
JP-900P:	For Becton Dickinson blood pressure transducers
JP-920P:	For Edwards Lifesciences (Baxter) blood pressure transducers
JP-960P:	For Biosensor blood pressure transducers
JP-910P:	For other blood pressure transducers


JP-900P


JP-910P


JP-920P

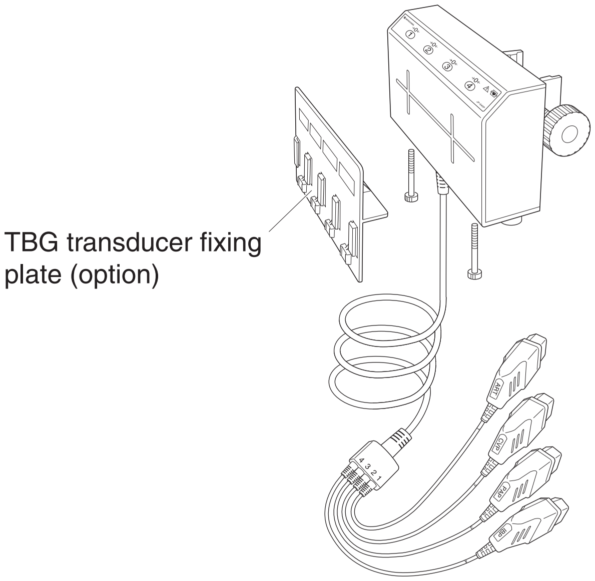

Connector
Attach label


IBP
PAP
P1
RAP
P2
LAP
P3
ICP
P4
FEM
P5
RAD
P6
U A
P7
U V
P8
ART
CVP

Blood pressure site label

JP-940P IBP Connection Box

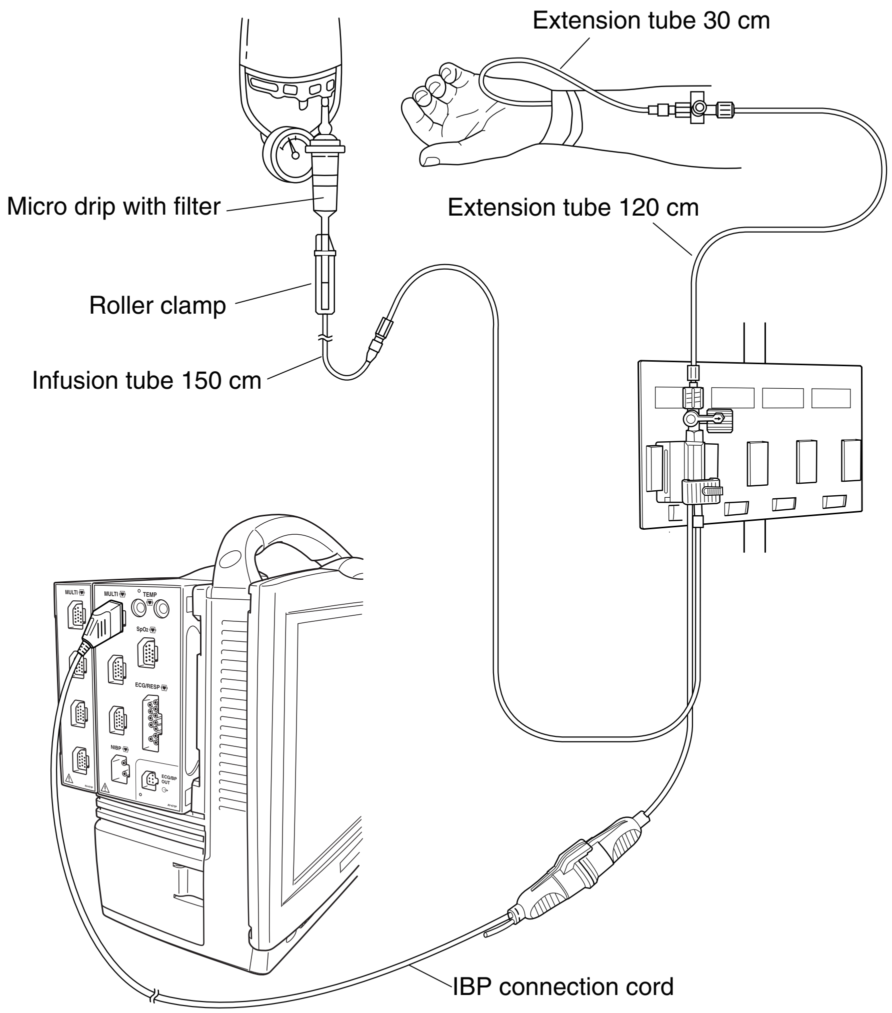
For connecting a Becton Dickinson's Life Kit DX series disposable blood pressure transducer to the unit. An optional TBG transducer fixing plate is required.


TBG transducer fixing plate (option)

Installing the Blood Pressure Measuring Device

The following describes installing the DX-360 Becton Dickinson disposable blood pressure transducer. When using other blood pressure transducers and measuring kits, refer to the respective instruction manuals.

Typical Configuration Example


Extension tube 30 cm
Micro drip with filter
Extension tube 120 cm
Roller clamp
Infusion tube 150 cm
MULTI
MULTI
TEMP
SpO2
ECG/RESP
NIBP
ECG/BP OUT
IBP connection cord

Connecting Cables to the Unit

1. Connect the blood pressure transducer to the IBP connection cord.

2. Connect the IBP connection cord to the MULTI socket on the unit.

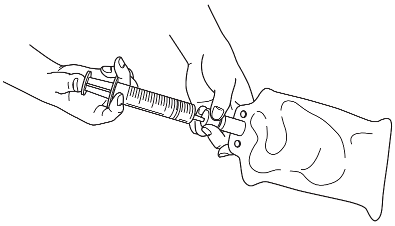
NOTE

When connecting the IBP connection cord to the unit after assembling the transducer and filling the tubes with saline solutions, make sure that the connector is not wet.

Assembling the Transducer

NOTE

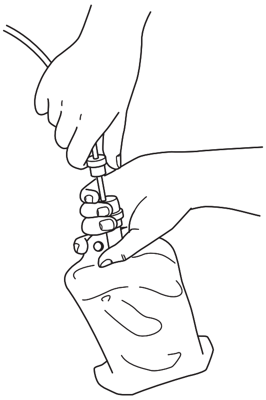
- The DX series disposable transducers are sterilized by EOG. Keep them clean after opening.
- Check that connectors and caps are firmly connected and the 3-way stopcock are directed to the correct way.
- The 3-way stopcocks and blood pressure tube openings are protected from contamination by the white aerated caps. Keep these white caps on until the solution is filled in completely. After filling the solution, replace the white caps with the yellow sealing caps which are in the separate bag.



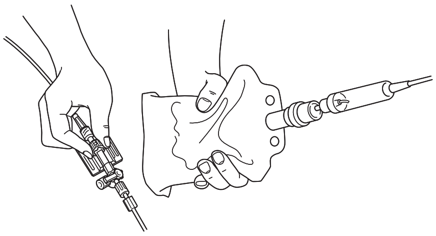
1. Inject 1 to 2 units of heparin into 1 mL sterilized physiological saline solution.

NOTE

Do not mix the solution yet.



2. Insert the needle at the tip of the micro-drip into the hole on the physiological saline pack.



3. Pressurize the physiological saline pack with your hand by pressing the flush cap to remove air from the pack.

4. When the solution in the micro-drip chamber is about 1/3 full (the stainless needle is in the solution), turn the physiological saline pack upside down and mix the physiological saline solution and heparin.

5. Place the saline pack in the pressure bag and hang the pressure bag on the stand.

6. Press the flush cap to completely fill the tube with saline solution.

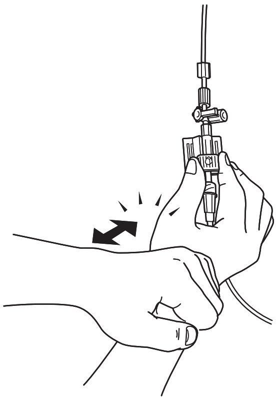
NOTE

Tap the bottom part of the micro-drip to remove air bubbles from under the filter.

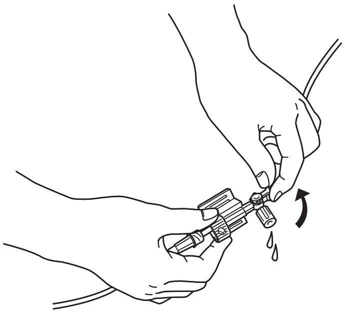
7. Fill in the transducer with the saline solution. Remove air bubbles by pressing the flush cap at above the saline pack, then bringing the flush cap down.

   If the air bubbles cannot be removed from the transducer:

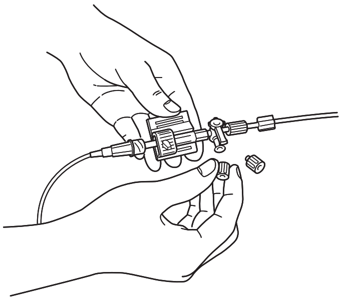
   i) Hold the transducer higher than the saline pack to flow the saline solution back into the saline pack and fill the transducer again.



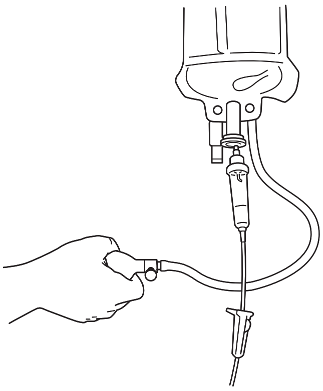
   ii) Tap the transducer lightly and flush the transducer slowly. Do not tap too hard because the air bubbles may break into small bubbles which are difficult to remove.



   iii) Check that there are no air bubbles in the transducer, tubes and 3-way stopcocks.



8. Replace the white aerated caps with the yellow sealing caps.



9. Pressurize the pressure bag to 300 mmHg (40.0 kPa). The solution in the micro-chip chamber is about a third to half full.
   At this pressure, the drip rate should be 2 to 4 drops/min.

10. Check all connections and that there is no leakage in the circuit.

11. After about 30 minutes, check the pressure of the pressure bag and drip rate. Also check that there is no leakage in the circuit.

Adjusting Zero Balance

NOTE

There is no alarm for 30 seconds after adjusting zero balance.

Adjust zero balance in the following cases. Zero balance adjustment is important for accurate IBP measurement.

- Before starting measurement
- When the patient moved so that the height of the heart changed
- When the height of the blood pressure transducer changes
- When changes in the measured value are expected due to measurements over a long period of time or due to changes in the ambient temperature (check the pressure when exposed to air)
- IBP connection cord or transducer is changed

When the zero balance is not adjusted, the “ZERO IMBALANCE” message is displayed beside each IBP value.

Zero Balance Mode

There are two modes for adjusting zero balance.

- **All zero**

  Zero balance of all blood pressure lines exposed to air, except for ICP, is performed at the same time.
  Touch the ZERO ALL key on the PRESS window. The zero all function can also be assigned to one of the function keys. For details on the function keys, refer to Section 3 of the Administrator’s Guide.

  Adjust zero balance separately for ICP (intracranial pressure).

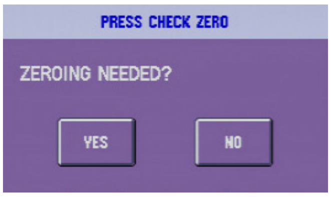
- **Individual zero**

  The zero balance is adjusted individually for one pressure line.
  Touch the ZERO CAL key on the PRESS window of the IBP label (or ICP window for the ICP).

  When using the optional JP-940P IBP Connection Box, the zero balance keys on the box can be used for each line.

Adjusting Zero Balance

1. When zero balance is not adjusted, the following dialog box appears.

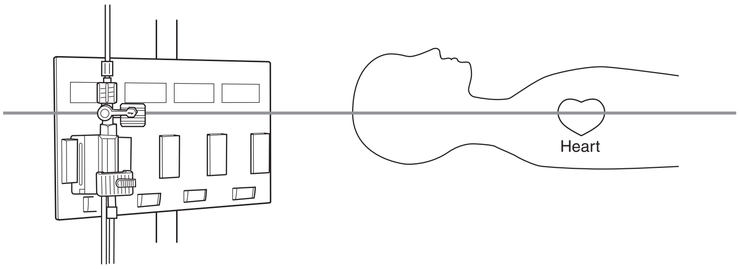


ZEROING NEEDED?

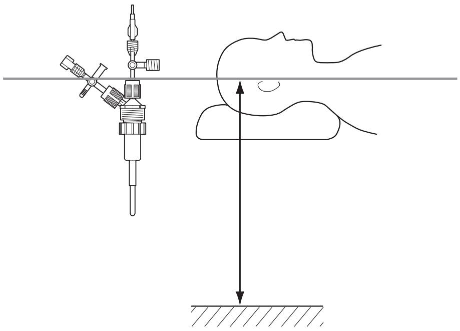
2. Touch the YES key to adjust zero balance. When the YES key is touched, the MAIN page of the PRESS window appears. Adjust zero balance by doing the following steps.

When the NO key is touched, the monitor starts monitoring IBP by using the zero balance value memorized in the connector of the IBP connection cord and the “ZERO IMBALANCE” messages disappear. The IBP values appear on the screen. If necessary, adjust zero balance by doing the following steps.

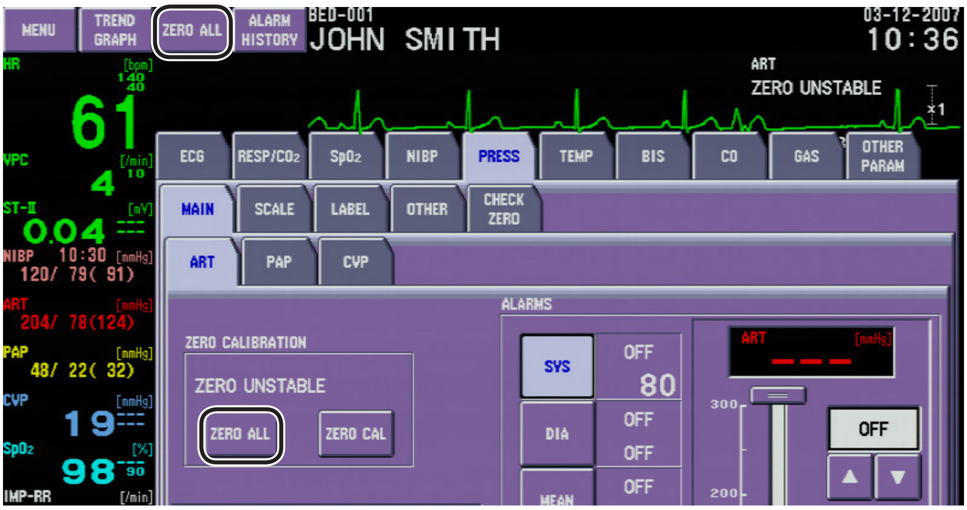
3. Move the dome up or down so that the 3-way stopcock on the transducer is at the level of the right atrium of the patient and open the air release opening of the 3-way stopcock to air.



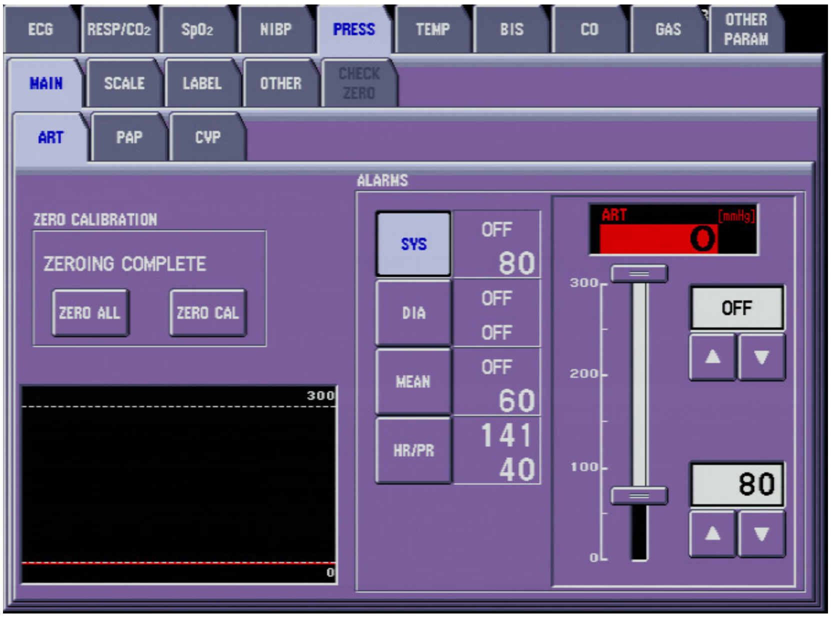
When measuring the intracranial pressure, adjust the 3-way stopcock of the catheter to the level of the ventricle and open the air release opening of the 3-way stopcock to air.



4. Perform zero balance adjustment.
   - All Zero
     Touch the ZERO ALL function key on the home screen or the ZERO ALL key on the MAIN page of the PRESS window. (Press [Menu] key → PRESS key)


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
03-12-2007
10:36
ART
ZERO UNSTABLE
HR [bpm] 140 40
61
VPC [/min] 10
4
ST-II [mV]
0.04
NIBP 10:30 [mmHg]
120/ 79(91)
ART [mmHg]
204/ 78(124)
PAP [mmHg]
48/ 22(32)
CVP [mmHg]
19
SpO2 [%] 90
98
IMP-RR [/min]
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
ART
PAP
CVP
ALARMS
ZERO CALIBRATION
ZERO UNSTABLE
ZERO ALL
ZERO CAL
SYS
OFF
80
DIA
OFF
OFF
MEAN
OFF
ART [mmHg]
300
200
OFF
▲
▼

When the “ZEROING COMPLETE” message is displayed on the screen, zero balance adjustment is completed.

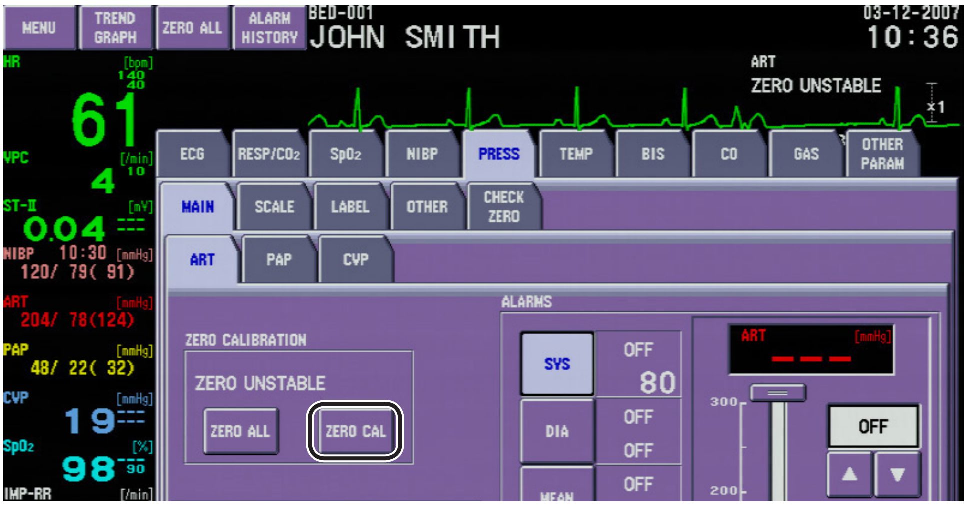

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
ART
PAP
CVP
ALARMS
ZERO ALL
ZERO CAL
SYS
DIA
MEAN
HR/PR
ART [mmHg]
OFF
▲ ▼

ZERO CALIBRATION

ZEROING COMPLETE

- Individual Zero
  i) Display the MAIN page of the desired label on the PRESS window.
  Press [Menu] key → PRESS key → MAIN tab → label tab

  ii) Touch the ZERO CAL key.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
03-12-2007
10:36
HR [bpm]
61
VPC [/min]
4
ST-II [mV]
0.04
NIBP 10:30 [mmHg]
120/ 79(91)
ART [mmHg]
204/ 78(124)
PAP [mmHg]
48/ 22(32)
CVP [mmHg]
19
SpO2 [%]
98
IMP-RR [/min]
x1
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
ART
PAP
CVP
ALARMS
ZERO ALL
ZERO CAL
SYS
DIA
MEAN
ART [mmHg]
OFF
▲ ▼

ART
ZERO UNSTABLE

ZERO CALIBRATION

ZERO UNSTABLE

When the “ZEROING COMPLETE” message is displayed, zero balance adjustment is completed.

5. Close the 3-way stopcock.

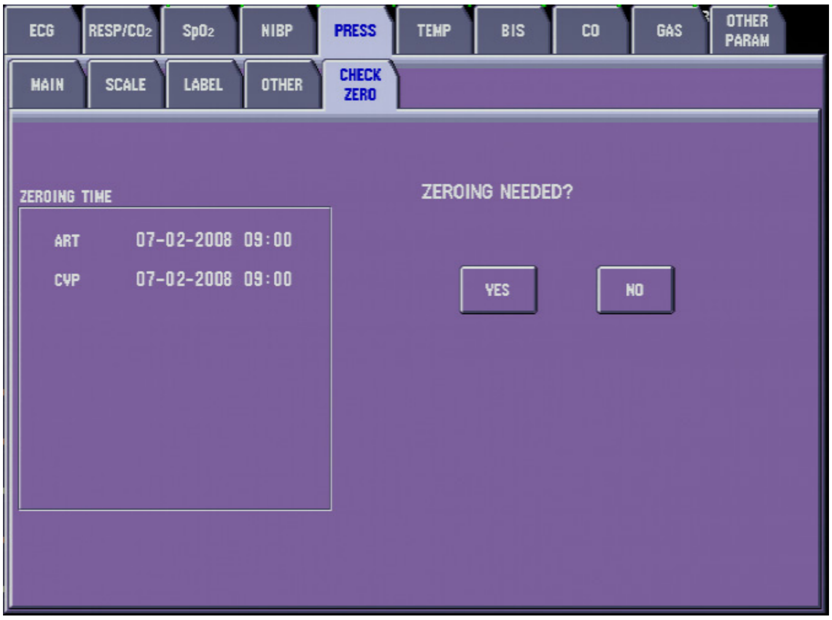
After adjusting zero balance and closing the 3-way stopcock, IBP is ready to be measured. The IBP value and blood pressure waveform appear on the screen.

Memorizing the Zero Balance Values

The zero values are saved in memory in the connector of the IBP connection cord when zero balance is performed. Therefore, you don’t need to adjust the zero balance again when connecting the IBP connection cord to the different socket.

The CHECK ZERO Page

This page becomes active when zero balance is not adjusted. Zero balance can also be adjusted on the CHECK ZERO page.



ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
YES
NO

ZEROING TIME

ART 07-02-2008 09:00

CVP 07-02-2008 09:00

ZEROING NEEDED?

Monitoring IBP

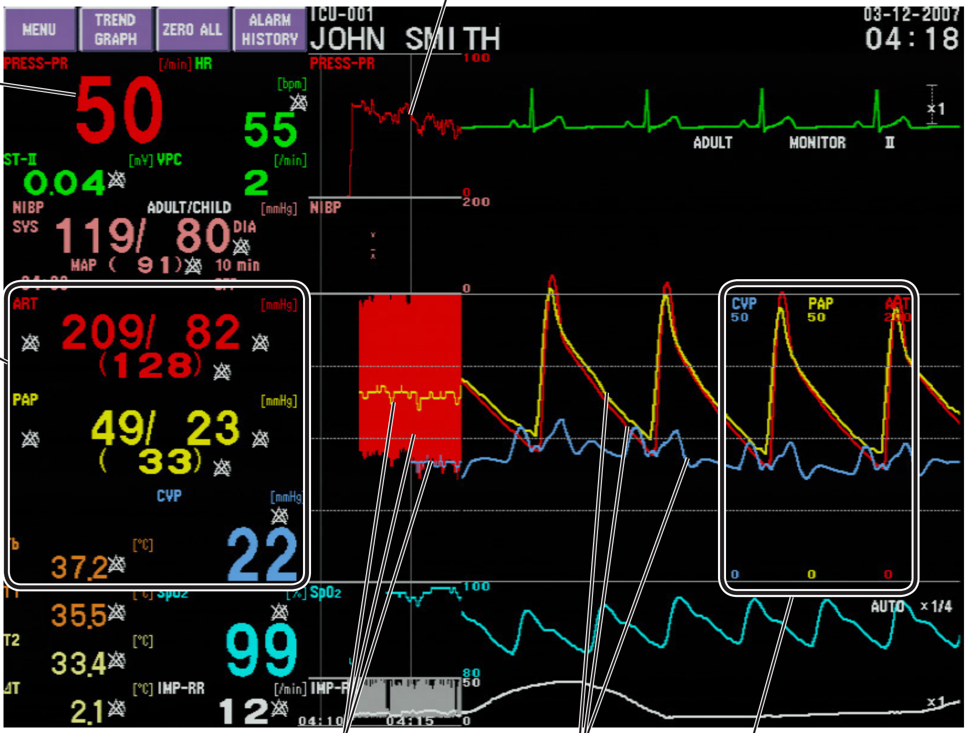
When the 3-way stopcock is closed after zero balance, you can start IBP monitoring.

IBP Information on the Home Screen

The blood pressure waveform and scale correspond to the color of the IBP values displayed.

There are three ways of displaying the IBP waveforms: common, separate or dual. The type of scale can be changed on the OTHER page of the PRESS window or WAVES page of the DISPLAY window. Refer to the “Selecting the IBP Waveform Display Mode” section.

When Monitoring 3 Channels on Common Scale


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
03-12-2007
04:18
PRESS-PR
HR
50
55
ST-II
VPC
0.04
2
NIBP
SYS
ADULT/CHILD
DIA
119/ 80
MAP (91)
10 min
ART
209/ 82
(128)
PAP
49/ 23
(33)
CVP
22
37.2
35.5
33.4
2.1
SpO2
99
IMP-RR
12
ADULT
MONITOR
II
×1
CVP 50
PAP 50
ART 200
AUTO ×1/4
04:10
04:15

Pulse rate trendgraph

Pulse rate (appears when sync sound source is set to PRESS)

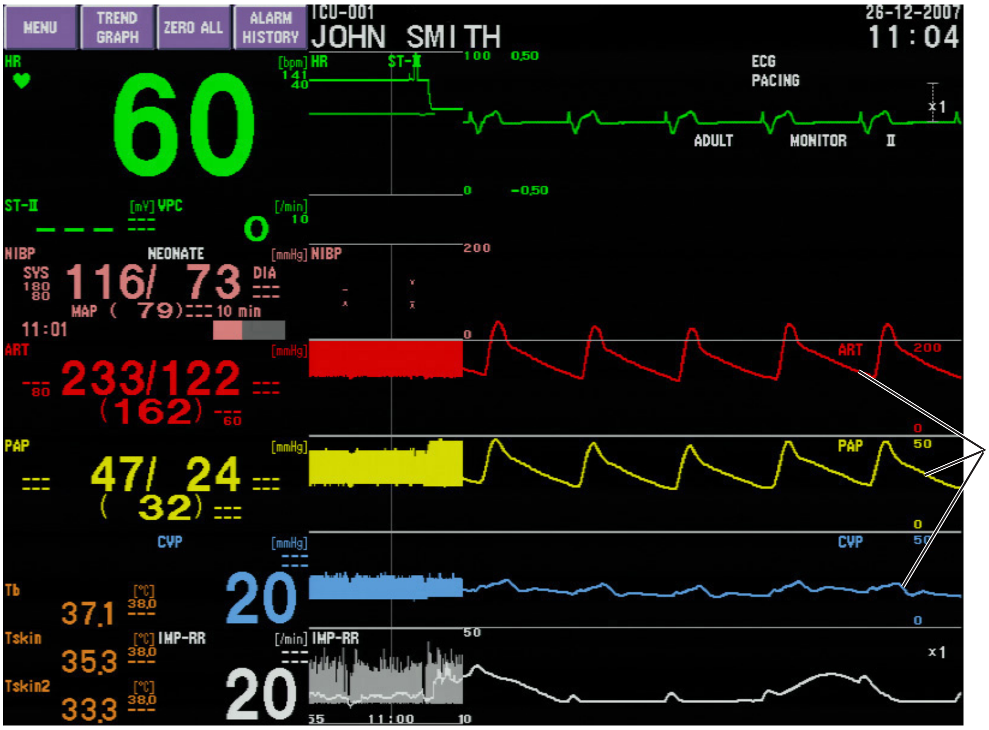
IBP values Systolic/Diastolic (Mean) or Mean

IBP trendgraphs

IBP waveforms displayed on the same scale

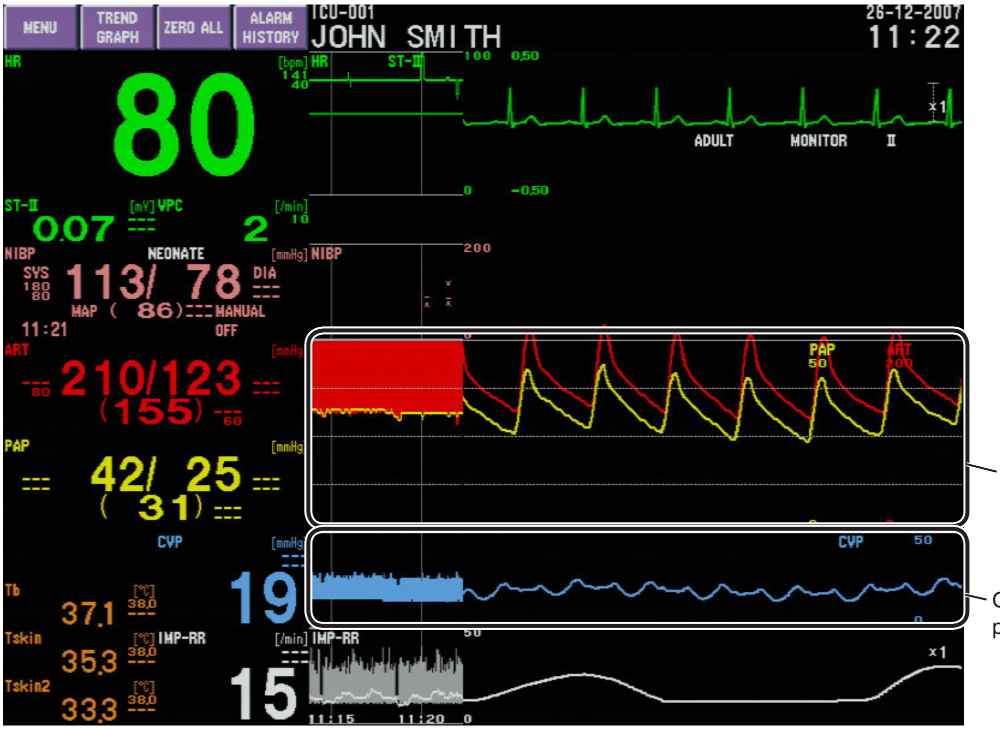
Scale of IBP trendgraphs and waveforms

When Monitoring 3 Channels on Separate Scale


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
26-12-2007
11:04
HR
60
ST-II
VPC
0
ECG
PACING
ADULT
MONITOR
II
NIBP
NEONATE
SYS
116/ 73
DIA
MAP (79)
10 min
11:01
ART
233/122
(162)
PAP
47/ 24
(32)
CVP
20
Tb
37.1
Tskin
35.3
Tskin2
33.3
IMP-RR
20
ART
200
PAP
50
CVP
50

IBP waveforms displayed on individual scale

When Monitoring 3 Channels on Dual Scale


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
26-12-2007
11:22
HR
80
ST-II
0.07
VPC
2
ADULT
MONITOR
II
NIBP
NEONATE
SYS
113/ 78
DIA
MAP (86)
MANUAL OFF
11:21
ART
210/123
(155)
PAP
42/ 25
(31)
CVP
19
Tb
37.1
Tskin
35.3
Tskin2
33.3
IMP-RR
15
PAP
50
ART
200
CVP
50

Arterial blood pressures

Other blood pressures

Changing IBP Settings

Change settings on the IBP window. The following settings can be changed for monitoring IBP.

- Label
- Scale
- IBP alarm limits
- Adjust zero balance. Refer to the “Adjusting Zero Balance” section.
- IBP calculation mode
- Numeric data display mode
- CPP display on or off (on the ICP window only)
- Sync source
- Sync sound pitch
- Pulse rate display on or off
- Waveform display mode (scale mode)
- PPV/SPV display on or off
- PPV/SPV average time

The pressure unit (mmHg or kPa) can be set on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator’s Guide.

The noise filter and IBP data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

The IBP waveform sweep speed and the displayed IBP parameters on the home screen can be selected on the DISPLAY window. Refer to Section 3 of the User’s Guide Part I.

Changing the Label

At shipment, the blood pressure lines are labeled as P1 to P7. You can use these labels, but it is recommended to label the site properly for proper processing of the waveform.

The labels are saved in memory in the connector of the IBP connection cord. Once the label is set, you don’t need to set the label again when the IBP connection cord is connected to a different socket.

If the IBP connection cord whose label is set by another monitor and which the label is not used on this monitor is connected to this monitor, the label appears from P1 to P7.

Setting labels is important for the following reasons.

- Prevents confusion of the blood pressure lines
- Measures the PCWP (Pulmonary Capillary Wedge Pressure) from the PAP (Pulmonary Artery Pressure)
- Lists the ART (Arterial Pressure), PAP (Pulmonary Artery Pressure), and CVP

(Central Venous Pressure) values in the hemodynamics list

- Calculates CPP (Cerebral Perfusion Pressure) from the ICP (Intracranial Pressure) and the highest priority arterial blood pressure value when measuring the ICP
  Priority
  ART, ART2, RAD, DORS, AO and FEM
- The display area of the blood pressure line measured is determined by the priority of the labels.
- The pulse rate is counted according to the priority of the blood pressure labels.

Types of Labels

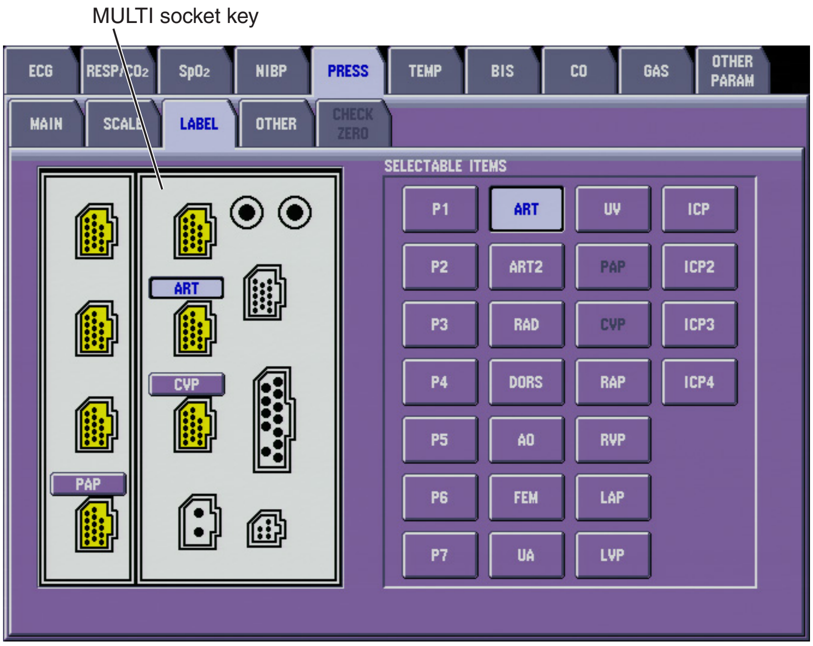
There are 15 labels. The labels are listed in the display priority.

ART:	Arterial Pressure Up to two blood pressure lines can be set (ART, ART2)
RAD:	Radial Artery Pressure
DORS:	Dorsal Artery Pressure
AO:	Aortic Pressure
FEM:	Femoral Artery Pressure
UA:	Umbilical Artery Pressure
LVP:	Left Ventricular Pressure
P1 to P7:	Up to 7 blood pressure lines can be set.
UV:	Umbilical Venous Pressure
PAP:	Pulmonary Artery Pressure
CVP:	Central Venous Pressure
RAP:	Right Atrial Pressure
RVP:	Right Ventricular Pressure
LAP:	Left Atrial Pressure
ICP, ICP2 to ICP4:	Intracranial Pressure Up to 4 pressure lines can be set.

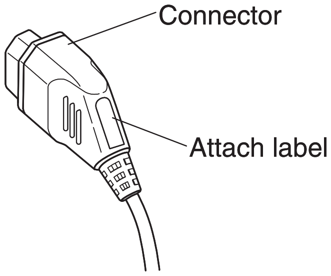
Changing the Labels

1. Display the LABEL page of the PRESS window.
   Press [Menu] key → PRESS key → LABEL tab.

2. On the LABEL page, touch the MULTI socket key corresponding to the MULTI socket to which the IBP connection cord of the blood pressure line you want to label is connected.


MULTI socket key
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SELECTABLE ITEMS
ART
CVP
PAP
P1
ART
UV
ICP
P2
ART2
PAP
ICP2
P3
RAD
CVP
ICP3
P4
DORS
RAP
ICP4
P5
AO
RVP
P6
FEM
LAP
P7
UA
LVP

3. Select the label appropriate for the blood pressure line from the <SELECTABLE ITEMS>box.


Connector
Attach label

4. Attach the blood pressure site label to the connector of the IBP connection cord.

5. To set the label of another blood pressure line, repeat steps 2 to 4.

6. Press the [Home] key to return to the home screen.

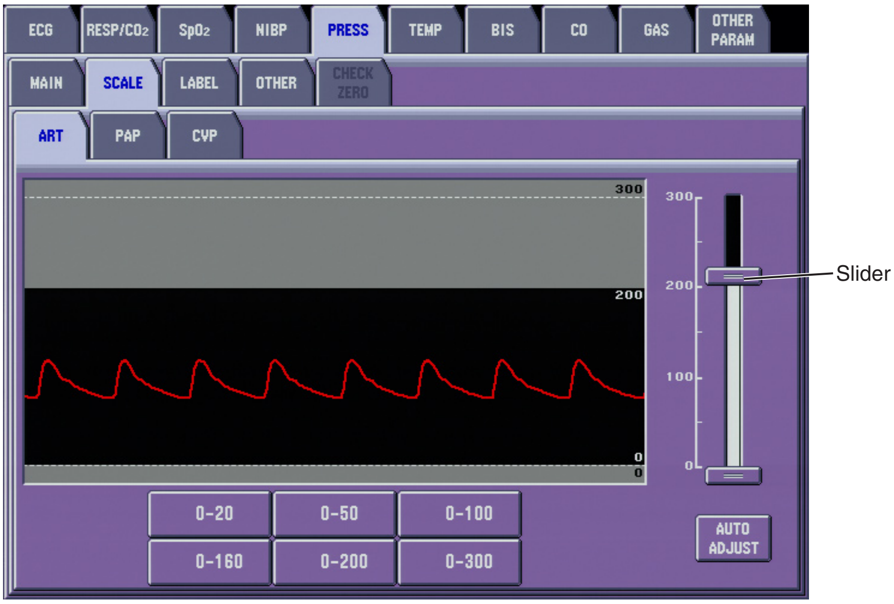
Changing the Scale

The scale can be individually changed for every blood pressure line for easy monitoring of the blood pressure waveform. The same scale is used on both the home screen and PRESS window (or ICP window).

1. Display the SCALE page of the IBP label on the PRESS window.
   Press [Menu] key → PRESS key → SCALE tab → IBP label tab.

2. Select the scale by touching the desired scale key. Use the sliders to adjust the scale.

   Or, touch the AUTO ADJUST key to automatically select to the appropriate scale for the displayed waveform.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
ART
PAP
CVP
300
200
0
0
300
200
100
0
Slider
0-20
0-50
0-100
0-160
0-200
0-300
AUTO ADJUST

To change the scale of another blood pressure line, repeat steps 1 and 2.

3. Press the [Home] key to return to the home screen.

Changing the IBP and Pulse Rate Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower systolic, diastolic and mean IBP alarm limits of all monitoring labels and pulse rate alarm limits of the highest priority arterial blood pressure on the PRESS window. You can set all alarms, including the upper and lower IBP alarm limits and pulse rate alarm limits, on the ALARM LIMITS window (See Operator’s Manual or Section 5 of the User’s Guide Part I). The pulse rate alarm limits can also be changed on the SpO$_2$ window.

For CVP, RAP, LAP and ICP lines, only the mean alarm limits can be set.

Setting Range

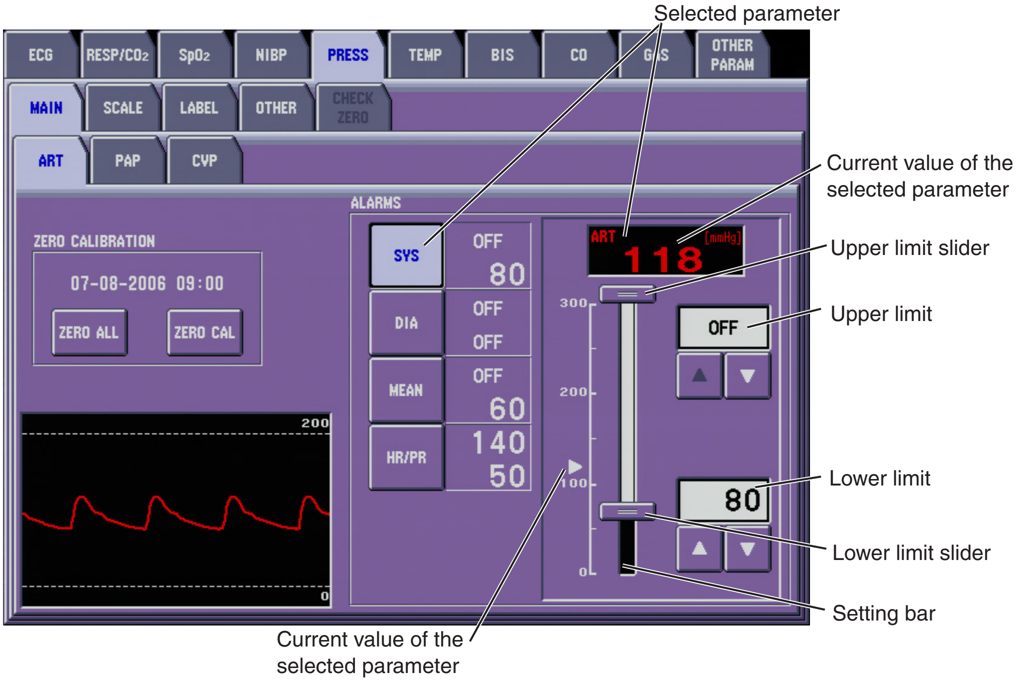
IBP upper limit: 2 to 300 mmHg in 2 mmHg steps (0.5 to 40.0 kPa in 0.5 kPa steps), OFF
(default setting: SYS All labels: OFF
DIA All labels: OFF
MEAN All labels: OFF)
IBP lower limit: OFF, 0 to 298 mmHg in 2 mmHg steps (0.0 to 39.5 kPa in 0.5 kPa steps)
(default setting: SYS ART/ART2/RAD/DORS/AO/FEM: OR/ICU-80 mmHg (10.5 kPa), NICU-50 mmHg (6.5 kPa)
Other labels: OFF

DIA All labels: OFF
MEAN ART/ART2/RAD/DORS/AO/FEM: OR/ICU-60 mmHg (8.0 kPa) NICU-30 mmHg (4.0 kPa)
Other labels: OFF)

HR/PR upper limit:	When <SYNC SOURCE> is set to ECG: 16 to 300 beats/min in 1 beat/min steps, OFF When <SYNC SOURCE> is set to PRESS or SpO_2: 31 to 300 beats/min in 1 beat/min steps, OFF (default setting: OR/ICU-140, NICU-200)
HR/PR lower limit:	When <SYNC SOURCE> is set to ECG: OFF, 15 to 299 beats/min in 1 beat/min steps When <SYNC SOURCE> is set to PRESS or SpO_2: OFF, 30 to 299 beats/min in 1 beat/min steps (default setting: OR/ICU-50, NICU-100)

1. Display the MAIN page of the IBP label on the PRESS window.
   Press [Menu] key → PRESS key → MAIN tab → IBP label tab.

2. Touch the SYS key to change the systolic alarm setting.
   Touch the DIA key to change the diastolic alarm setting.
   Touch the MEAN key to change the mean alarm setting.
   Touch the HR/PR key to change the heart rate/pulse rate alarm setting.


Selected parameter
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
ART
PAP
CVP
ALARMS
ZERO CALIBRATION
07-08-2006 09:00
ZERO ALL
ZERO CAL
200
0
SYS
OFF
80
DIA
OFF
OFF
MEAN
OFF
60
HR/PR
140
50
ART
[mmHg]
118
300
200
100
0
OFF
80
Current value of the selected parameter
Upper limit slider
Upper limit
Lower limit
Lower limit slider
Setting bar
Current value of the selected parameter

3. Touch and drag the slider to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

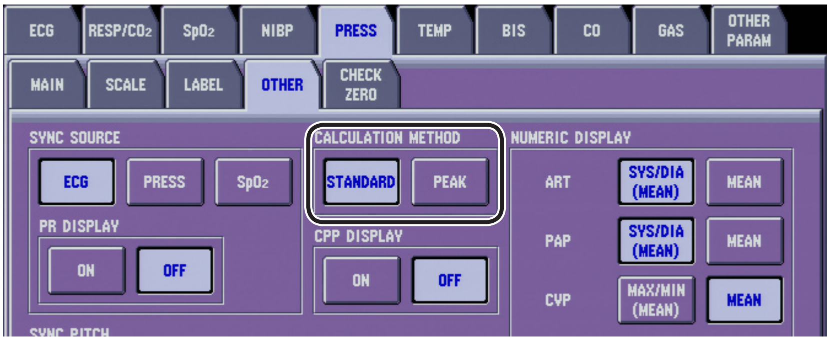
Selecting the Mode for Calculating IBP

There are two calculation modes for displaying the IBP values.

STANDARD:	The IBP values are calculated by moving average. The monitor averages the latest 8 consecutive pulses and displays this average as the IBP value. When a new pulse is detected, the IBP value is recalculated using the latest 8 pulses. The IBP value display is updated every 3 seconds.
PEAK:	The systolic, diastolic and mean values of the highest pulse wave in the latest 8 consecutive pulses are displayed as the IBP values. The IBP value display is updated every 3 seconds. When connected IABP causes the IBP values to vary greatly, use PEAK to improve measurement accuracy.

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select either STANDARD or PEAK in the <CALCULATION METHOD> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
CALCULATION METHOD
STANDARD
PEAK
CPP DISPLAY
ON
OFF
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
SYNC PITCH

3. Press the [Home] key to return to the home screen.

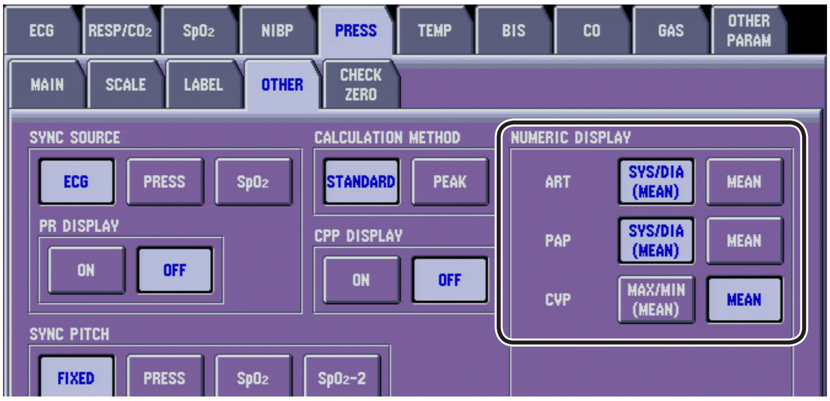
Selecting the Data Display Mode on the Home Screen

The displaying mode of the IBP/ICP values can be selected for the home screen. Select this display mode for every blood pressure line.

SYS/DIA/(MEAN):	Displays the systolic blood pressure (SYS), diastolic blood pressure (DIA) and the averaged blood pressure (MEAN).
MEAN:	Displays only the averaged blood pressure.

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select display mode for each label in the <NUMERIC DISPLAY> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
CALCULATION METHOD
STANDARD
PEAK
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
PR DISPLAY
ON
OFF
CPP DISPLAY
ON
OFF
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2

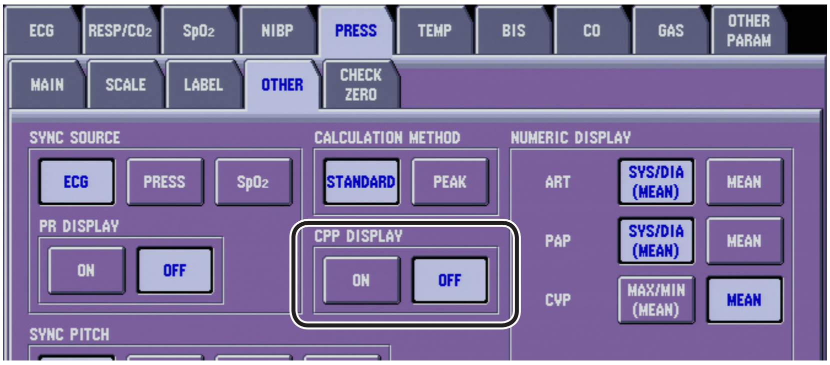
3. Press the [Home] key to return to the home screen.

Displaying CPP On or Off

When monitoring ICP, CPP (cerebral perfusion pressure) display on the home screen can be set to on or off.

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select ON or OFF in the <CPP DISPLAY> box to set CPP display on or off.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
CALCULATION METHOD
STANDARD
PEAK
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
PR DISPLAY
ON
OFF
CPP DISPLAY
ON
OFF
SYNC PITCH

3. Press the [Home] key to return to the home screen.

Changing the Sync Sound Source

You can select ECG, SpO_2 pulse (SpO_2) or arterial blood pressure pulse (PRESS) as the sync source. When the arterial blood pressure pulse is selected, the blood pressure of the highest priority label is used. The sync source can also be changed on the ECG and SpO_2 windows.

When pulse wave and pressure waveform are irregular because of an IABP, select ECG.

NOTE

- When heart rate is unstable because of an ESU, select SpO_2 or PRESS.

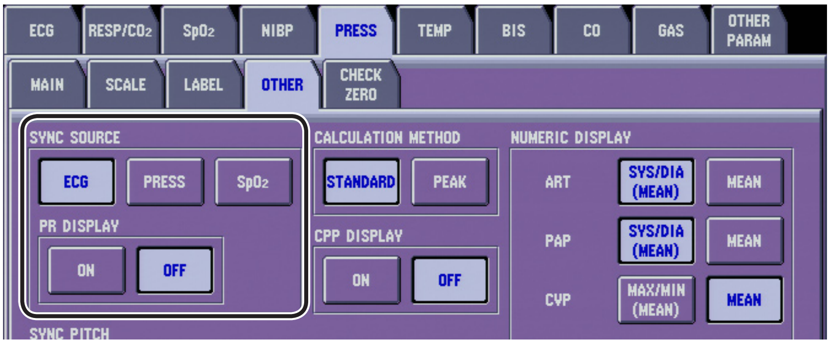
- When the connection cord of SpO_2 or IBP of the arterial blood pressure is disconnected from the monitor and an alarm occurs when the sync source is set to SpO_2 or PRESS, the sync source changes to ECG when the alarm is silenced by pressing the [Silence Alarms] key.
  The sync source returns to SpO_2 or PRESS when the SpO_2 or IBP is monitored again. When using PRESS as the sync source, adjust zero balance.
- When the sensor is detached from the patient and alarm occurs, and the sync source is set to SpO_2 or PRESS, the sync source does not change to ECG when the alarm is silenced, and "- - -" is displayed for PR.
- The SpO_2-2 cannot be set to the sync sound source.

When the sync source is set to ECG and ECG is not measured, there is no sync sound.

When SpO_2 or PRESS is selected, the pulse rate is displayed to the left of the heart rate on the screen and the sync mark synchronizes with the pulse.

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select the sync source in the <SYNC SOURCE> box.
   ECG: QRS
   PRESS: Pulse wave of the highest priority arterial blood pressure
   SpO_2: SpO_2 pulse


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
CALCULATION METHOD
STANDARD
PEAK
CPP DISPLAY
ON
OFF
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
SYNC PITCH

To display the pulse rate to the left of the heart rate on the home screen, select ON for <PR DISPLAY>. This setting is only available when <SYNC SOURCE> is set to ECG.

3. Press the [Home] key to return to the home screen.

Selecting Sync Sound Pitch

The sync sound can be variable pitch or fixed pitch pips. The fixed pitch is high pitch as the default, but medium or low pitch can also be set on the SYSTEM SETUP window (see Section 3 of the Administrator's Guide). When you select variable pitch, the pitch of the sync sound changes according to SpO_2 value or systolic BP value of the arterial blood pressure so that you can recognize the change on the patient from the pitch of the sync sound without looking at the monitor. The sync pitch can also be changed on the ECG and SpO_2 windows.

When using AY-661P, AY-663P, AY-671P or AY-673P input unit, the sync sound pitch can be set to change according to the SpO_2 value of the second SpO_2 (SpO_2-2) when monitoring dual SpO_2. (AY-661P or AY-663P input units are not available for BSM-6000A series.)

When the sync sound source is set to SpO_2 and the SpO_2 value is below 81%SpO_2, the low pitch is automatically selected.

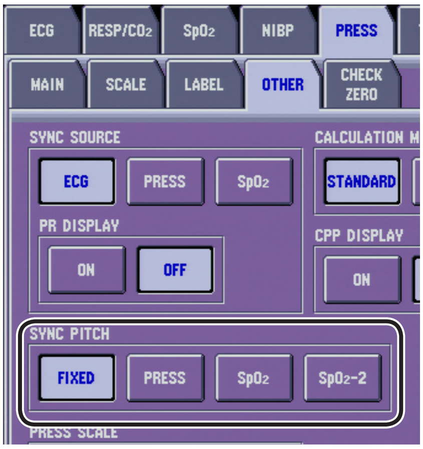
When the sync sound source is set to SpO_2 and the "CHECK PROBE" or "DETECTING PULSE" message is displayed on the screen, the sync sound stops.

When the sync sound source is set to ECG or PRESS, the sync pitch is set to SpO_2 and the SpO_2 cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2, the sync pitch is set to PRESS and the IBP cannot be displayed on the screen, the low pitch is automatically selected.

When the sync sound source is set to ECG or SpO_2 and the IBP connection cord is disconnected, the low pitch is automatically selected. After connecting the IBP connection cord, adjust zero balance.

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.



2. Select the sync sound pitch from the <SYNC PITCH> box.

FIXED:	The pitch is fixed to the pitch selected on the SYSTEM SETUP window.
PRESS:	The pitch is high when the BP value is above 120 mmHg. The pitch is low when the BP value is below 20 mmHg. The pitch changes from high to low in 20 steps for each 5 mmHg change between 120 and 20 mmHg BP value. The BP value of the highest priority arterial blood pressure is used.
SpO_2 and SpO_2-2:	The pitch changes in 20 steps from high to low for each 1%SpO_2 change in SpO_2 value between 100%SpO_2 and 81%SpO_2. SpO_2-2 is only available when using AY-661P, AY-663P, AY-671P or AY-673P input unit.

3. Press the [Home] key to return to the home screen.

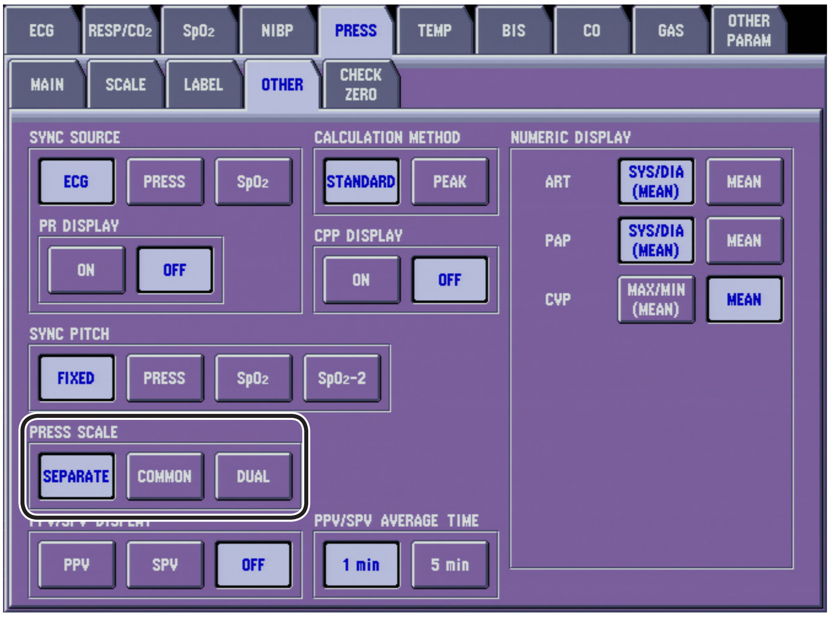
Selecting the IBP Waveform Display Mode

There are three ways of displaying IBP waveforms. This setting can also be changed on the WAVES page of the DISPLAY window. Refer to Operator's Manual or Section 4 of the User's Guide Part I.

COMMON:	All IBP waveforms are displayed on the same scale.
SEPARATE:	IBP waveforms are displayed separately on different scales.
DUAL:	IBP waveforms are separated into arterial blood pressures and other type of blood pressures. The arterial blood pressures are labeled ART, ART-2, RAD, DORS, AO, FEM, UA, LVP and PRESS (P1 to P7).

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select the scale mode from the <PRESS SCALE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
CALCULATION METHOD
STANDARD
PEAK
CPP DISPLAY
ON
OFF
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PRESS SCALE
SEPARATE
COMMON
DUAL
PPV
SPV
OFF
PPV/SPV AVERAGE TIME
1 min
5 min

3. Press the [Home] key to return to the home screen.

Displaying PPV or SPV on the Home Screen

NOTE

This setting is common for all IBP labels. It only needs to be set on one label window.

Selecting PPV or SPV Display on the Home Screen

PPV (pulse pressure variability) or SPV (systolic pressure variability) of the IBP with the highest priority label of arterial blood pressure (ART, ART2, RAD, DORS, AO or FEM) can be displayed on the home screen.

PPV indicates the variability of the difference between systolic and diastolic pressure in one beat in the respiration cycle. PPV is calculated from the following equation.

$$\text{PPV} = \frac{\text{PPmax} - \text{PPmin}}{(\text{PPmax} + \text{PPmin}) / 2}$$

PP: instantaneous systolic pressure in one beat – instantaneous diastolic pressure in one beat
PPmax: maximum PP in one respiration cycle
PPmin: minimum PP in one respiration cycle

SPV indicates the variability of systolic pressure in the respiration cycle. SPV is calculated from the following equation.

$$\text{SPV} = \frac{\text{SPmax} - \text{SPmin}}{(\text{SPmax} + \text{SPmin}) / 2}$$

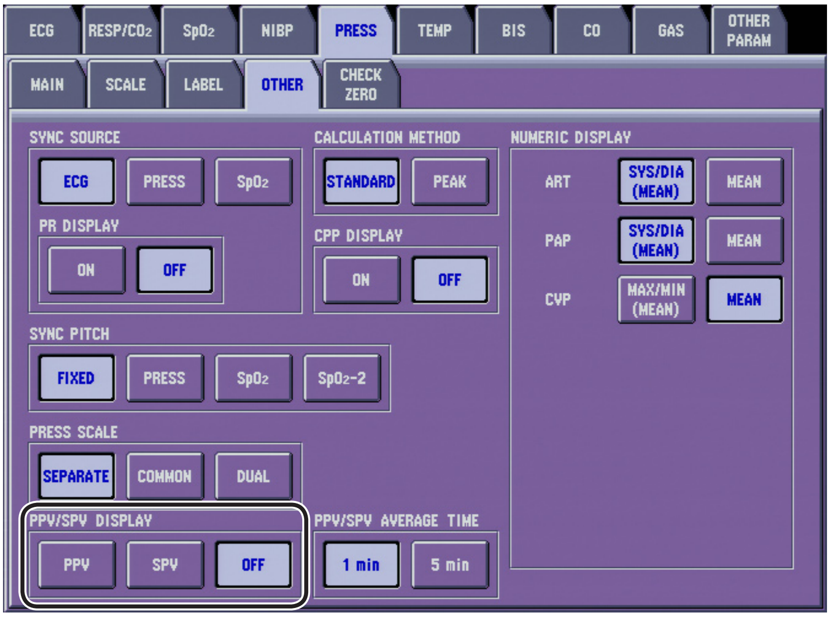
SP: instantaneous systolic pressure in one beat
SPmax: maximum SP in one respiration cycle
SPmin: minimum SP in one respiration cycle

NOTE

- PPV or SPV of IBP with the highest priority label of arterial blood pressure (ART, ART2, RAD, DORS, AO or FEM) is displayed. If the connection cord of IBP whose PPV or SPV is monitored is disconnected from the monitor, PPV or SPV of the blood pressure with the second priority label is monitored. If the disconnected IBP is connected again, PPV or SPV of the highest priority label is monitored again. In such a case, adjust zero balance.
- PPV or SPV is accurately measured when the patient is using a ventilator and when there is no patient movement and no arrhythmias. In the following cases, PPV or SPV is not accurate or cannot be measured.
  - Patient movement
  - Spontaneous respiration
  - Arrhythmia
  - Respiration rate less than 6 counts/min
  - Ventilation volume less than 8 mL/kg
  - Acute right heart failure

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select PPV, SPV or OFF in the <PPV/SPV DISPLAY> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
CALCULATION METHOD
STANDARD
PEAK
CPP DISPLAY
ON
OFF
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PRESS SCALE
SEPARATE
COMMON
DUAL
PPV/SPV DISPLAY
PPV
SPV
OFF
PPV/SPV AVERAGE TIME
1 min
5 min

3. Press the [Home] key to return to the home screen.

Changing PPV or SPV Average Time

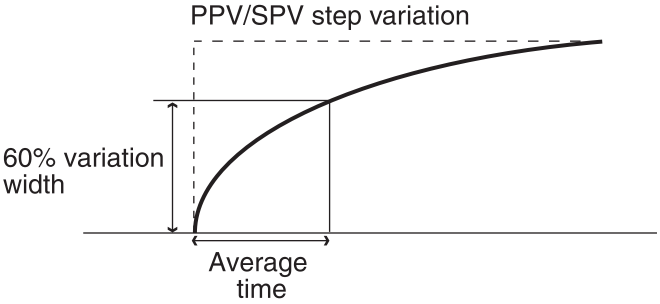
Select the averaging time for PPV or SPV display. five min is appropriate for monitoring variation for long term (more than an hour) with less noise interference.

NOTE

This setting is only available when “PPV” or “SPV” is selected for the “PPV/SPV DISPLAY” setting.

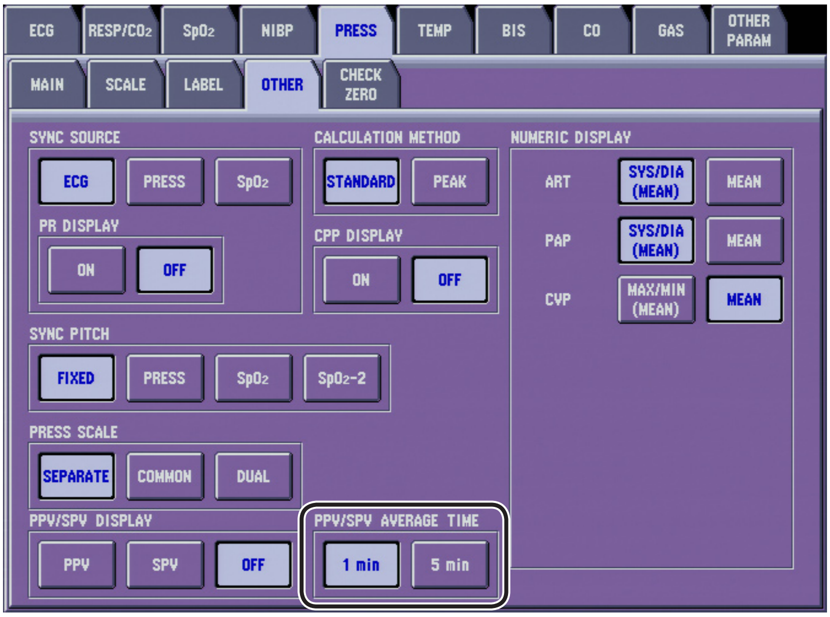
When the average time is longer, noise interference decreases but the response becomes slower. Normally, one minute is recommended.

The average time is the time when variation width reaches 60% when PPV/SPV is hypothetically varied in steps.


PPV/SPV step variation
60% variation width
Average time

1. Display the OTHER page of the PRESS window.
   Press [Menu] key → PRESS key → OTHER tab.

2. Select the average time in the <PPV/SPV AVERAGE TIME> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
SCALE
LABEL
OTHER
CHECK ZERO
SYNC SOURCE
ECG
PRESS
SpO2
PR DISPLAY
ON
OFF
CALCULATION METHOD
STANDARD
PEAK
CPP DISPLAY
ON
OFF
NUMERIC DISPLAY
ART
SYS/DIA (MEAN)
MEAN
PAP
SYS/DIA (MEAN)
MEAN
CVP
MAX/MIN (MEAN)
MEAN
SYNC PITCH
FIXED
PRESS
SpO2
SpO2-2
PRESS SCALE
SEPARATE
COMMON
DUAL
PPV/SPV DISPLAY
PPV
SPV
OFF
PPV/SPV AVERAGE TIME
1 min
5 min

3. Press the [Home] key to return to the home screen.

Section 7 Temperature Monitoring

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        Reusable Probes 7.3
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    Setting the Site for Calculating Temperature Difference 7.10
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General

To monitor temperature, attach the probe to the patient and connect the probe to the TEMP socket or MULTI socket on the unit.

Two probes can be connected to the TEMP sockets without using the temperature connection cord. Two probes can be connected to one temperature connection cord to measure 2 channels. Up to 4 channels can be measured.

By using the CO connection cord and catheter, the blood temperature of one channel can be measured. (Refer to Section 9.)

NOTE

- The monitor simulates the temperature signal of 27°C and 37°C inside the monitor. Monitoring this simulated signal periodically, the monitor self-diagnoses the temperature signal processor part of the monitor. When the monitor could not cover the 0 to 45°C measurement range, a “MPU MODULE ERROR” message is displayed.
- Temperature cannot be monitored on the AY-660P input unit by using the MULTI socket. Only the TEMP socket on the unit can be used.

Preparing for Temperature Monitoring

Preparation Flowchart

1. Select the probe.
2. Connect the probe to the TEMP socket on the unit or to the temperature connection cord. Connect the temperature connection cord to the MULTI socket on the unit.
3. Attach the probe to the patient.
4. Start monitoring and change necessary settings.

Selecting the Probe

Select the appropriate probe according to the purpose.

CAUTION

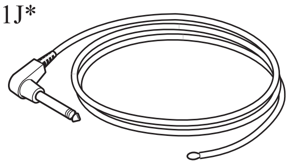
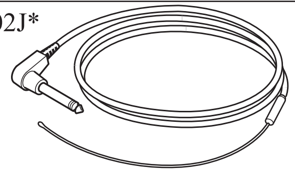
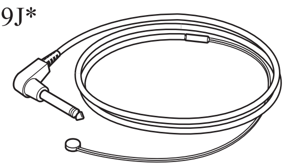
Select the appropriate probe for the patient. Using adult probes on premature infants and children may injure the mucous membrane.

CAUTION

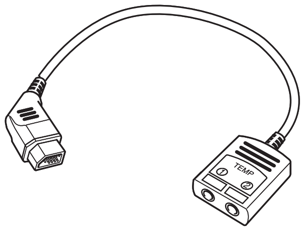
The insulation pad may irritate the skin. In long term monitoring, change the attachment site to prevent irritation.

Reusable Probes

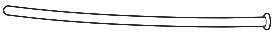
When connecting the temperature probe to the MULTI socket, the JT-900P temperature connection cord is required.

Thermistor Probe	Purpose
401J* 	For adult rectum/ esophagus
402J* 	For child rectum/ esophagus
409J* 	For body surface

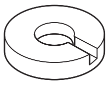
* These thermistor probes are available direct from YSI, Yellow Springs Instrument Inc., Yellow Springs Ohio 45387, USA; Phone +1 937-767-7241.



JT-900P temperature connection cord



401J comes with a probe cover**



409J comes with an insulation pad**

** These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Disposable Probes

The following probes can be used on this monitor. To use the disposable probes, the 5-15801 extension cable is required. When connecting these probes to the MULTI socket, the JT-900P temperature connection cord is also required.

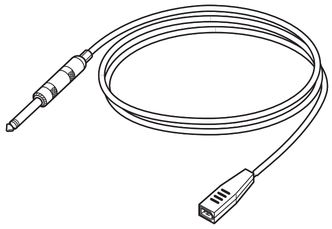
The disposable probes and the extension cable are available direct from Kendall Healthcare Products Company (www.kendallhq.com) or their suppliers.

CAUTION

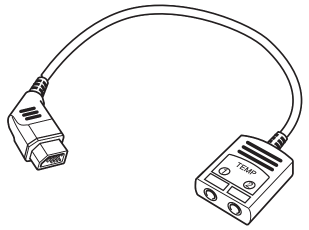
Do not reuse disposable probes on other patients.

Disposable Probe		Thickness	Purpose
Sonatemp	5-13212*	12F	For esophagus
	5-13218*	18F	
	5-13224*	24F	
Sheritemp	5-15610*	18F	For esophagus/rectum
	5-26101*	—	For tympanic membrane
Foley catheter	5-18808*	8F	For bladder
	5-18810*	10F	
	5-18812*	12F	
	5-18814*	14F	
	5-18816*	16F	
	5-18818*	18F	

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.



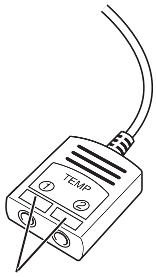
5-15801 extension cable



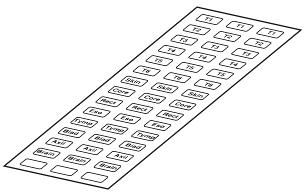
JT-900P temperature connection cord

Temperature Connection Cord

The temperature connection cord connector has a memory chip for saving the site label. Attach the temperature site label of the saved site.



Attach the label here



Temperature site label

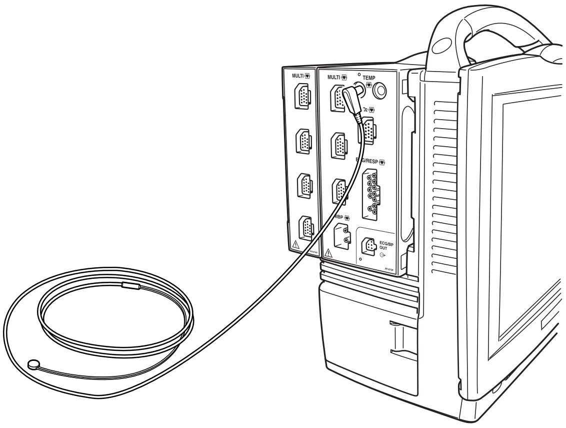
Connecting Cables and Attaching the Probe

Connecting Cable to the Unit

When Using the TEMP Socket

Connect the probe to the TEMP socket.

When using the disposable probe, connect the extension cable between the probe and TEMP socket.

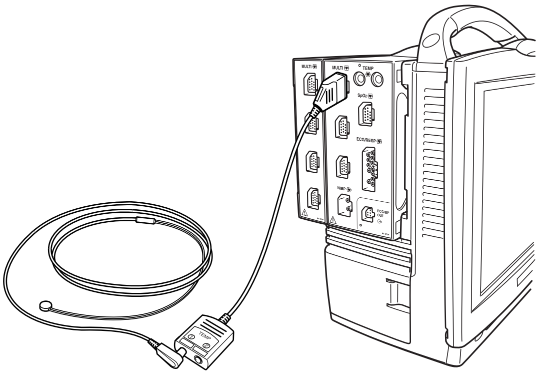


When connecting the 409J reusable probe for the body surface

When Using the MULTI Socket

Connect the probe to the temperature connection cord and connect the temperature connection cord to the MULTI socket on the unit.

When using the disposable probe, connect the extension cable between the probe and temperature connection cord.



When connecting the disposable probe (Sheritemp body surface: 5-16201)

Attaching the Probe to the Patient

Attach the probe to the patient by referring to the manual provided with the probe.

CAUTION

Select the appropriate probe for the patient. Using adult probes on premature infants and children may injure the mucous membrane.

CAUTION

After changing the temperature label, do not reconnect the probe to another jack. This may cause an incorrect label display and lead to misjudgment.

NOTE

When the measuring site is exposed directly to air, the temperature may be lower than normal. It takes about 20 to 30 minutes to reach the equilibrium temperature after attaching the sensor.

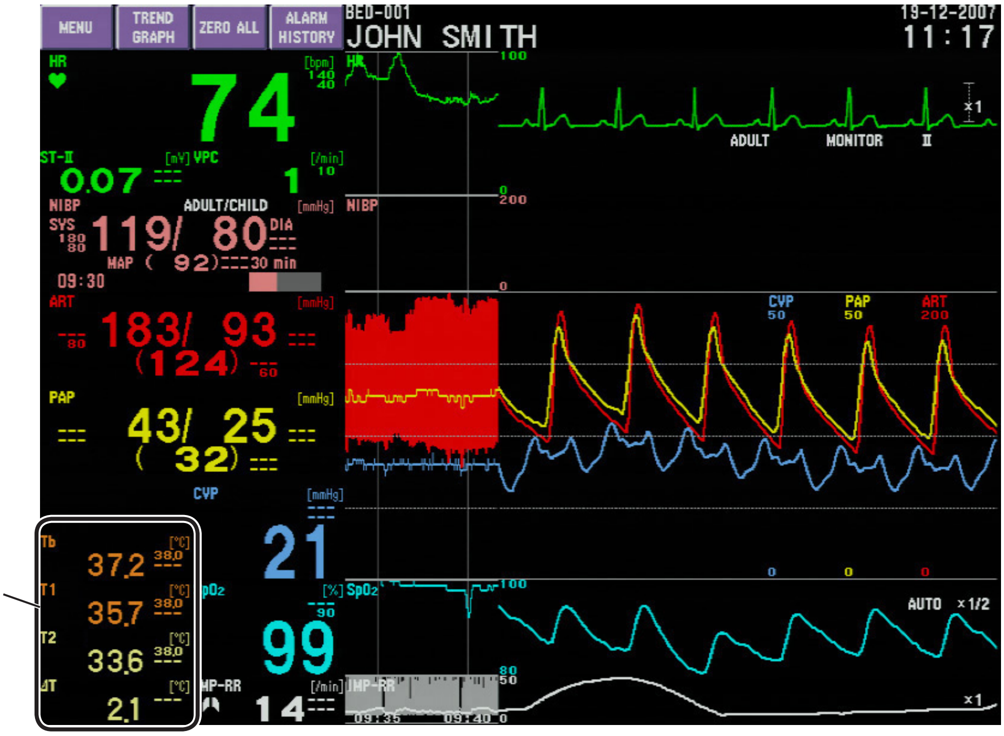
Using the Insulation Pad

The pad prevents the environmental temperature from affecting the sensor temperature and also prevents internal body heat from escaping at the attached site so that a stable temperature is obtained.

Monitoring Temperature

After completing the preparation, temperature data appears on the screen.

Temperature Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
19-12-2007
11:17
HR
74
ST-II
0.07
VPC
1
NIBP
ADULT/CHILD
119/ 80
MAP (92)
30 min
09:30
ART
183/ 93
(124)
PAP
43/ 25
(32)
CVP
21
Tb
37.2
T1
35.7
T2
33.6
ΔT
2.1
SpO2
99
IMP-RR
14
ADULT
MONITOR
II
AUTO
×1/2
×1

Temperature
The temperature values are displayed in the display priority of the label.

Changing Temperature Settings

Change settings on the TEMP window. The following settings can be changed for monitoring temperature.

- Label
- Temperature alarm limits
- Delta temperature equation setting

The temperature unit can be set to °C or °F on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.

The temperature data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Changing the Label

At shipment, the sites are labeled as T1 to T4. You can use these labels, but it is recommended to apply more descriptive labels for the sites to be measured, such as Tskin or Tcore.

When the temperature probe is connected to the TEMP socket, the labels are saved in monitor memory. Once the label is set, do not reconnect the temperature probe to the other TEMP socket.

When the temperature probe is connected to the MULTI socket with the temperature connection cord, the labels are saved in memory in the connector of the temperature connection cord. Once the label is set, you don't need to set the label again when the temperature connection cord is connected to a different socket.

If the temperature connection cord whose label is set by another monitor and which the label is not used on this monitor is connected to this monitor, the label appears from T1 to T4.

Types of Labels

There are 9 types of labels. The labels are listed in the display priority.

Tskin: Skin temperature
Up to 3 sites can be set. (Tskin, Tskin2, Tskin3)
Trect: Rectum temperature
Tcore: Core temperature
Tnaso: Nasal cavity temperature
Teso: Esophagus temperature
Ttymp: Tympanic membrane temperature
Tblad: Bladder temperature
Taxil: Axillary temperature
T1 to T4: Up to 4 sites can be set.

Types of Labels for Blood Temperature Measured Regions

When blood temperature is measured with a catheter and CO connection cord or when CCO is measured by a CCO monitor, the label is Tb.

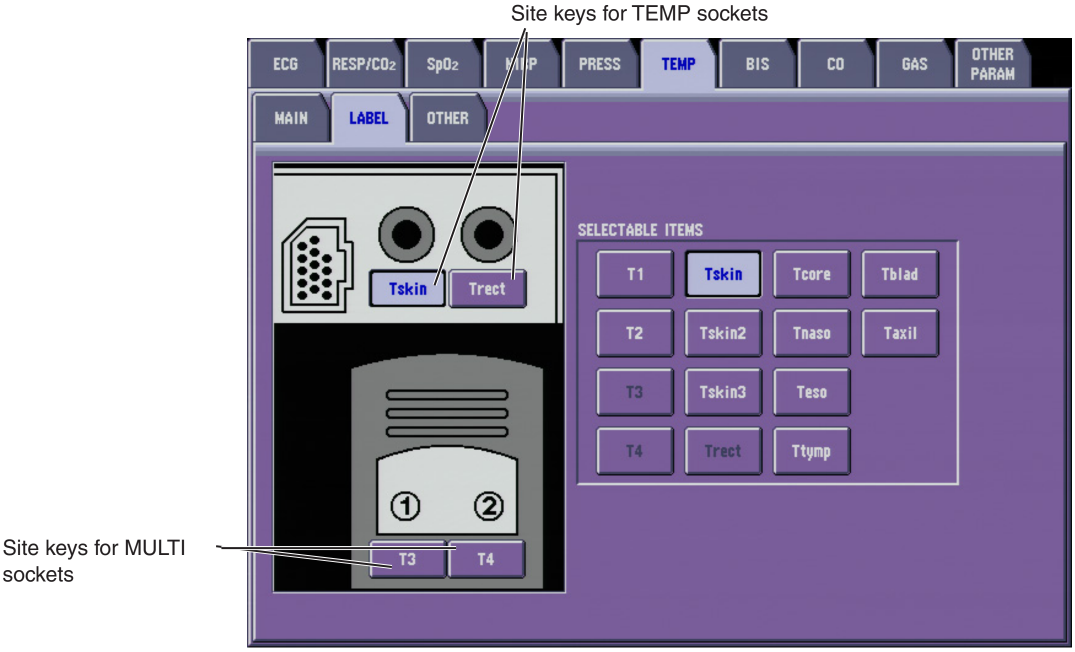
Changing the Label

CAUTION

After changing the temperature label, do not reconnect the probe to another jack. This may cause an incorrect label display and lead to misjudgment.

1. Display the LABEL page of the TEMP window.
   Press [Menu] key → TEMP key → LABEL tab.

2. Select the label appropriate for the measurement site.
   i) Select the site to be labeled.


Site keys for TEMP sockets
Site keys for MULTI sockets
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
LABEL
OTHER
Tskin
Trect
①
②
T3
T4
SELECTABLE ITEMS
T1
Tskin
Tcore
Tblad
T2
Tskin2
Tnaso
Taxil
T3
Tskin3
Teso
T4
Trect
Ttymp

   ii) Select the label from the <SELECTABLE ITEMS> box.

3. Press the [Home] key to return to the home screen.

When using the temperature connection cord, attach the temperature site label to the temperature connection cord connector.

Setting the Site for Calculating Temperature Difference

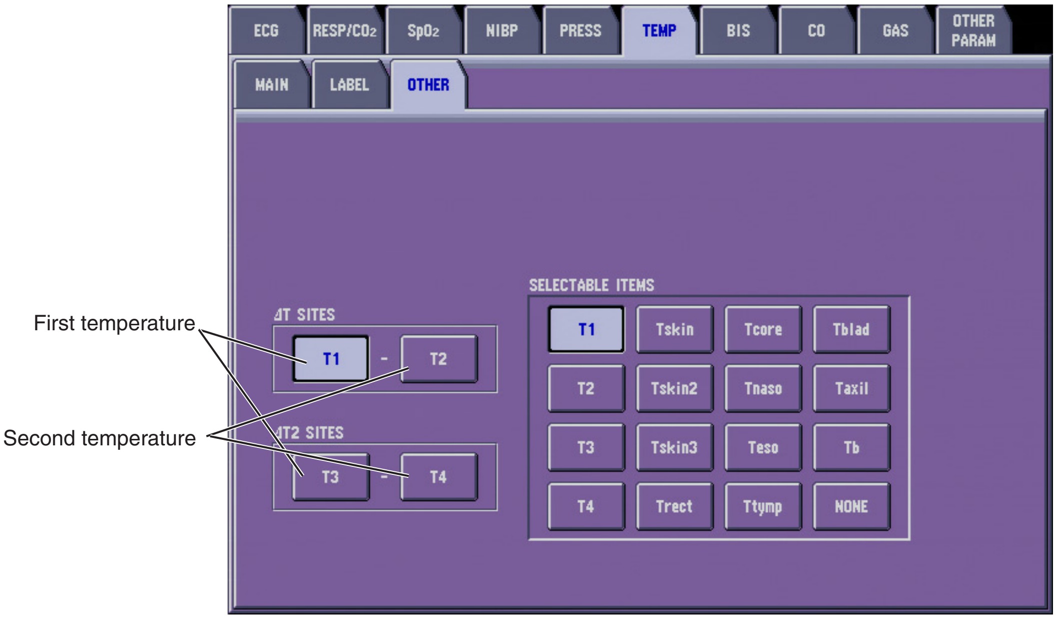
Temperature difference for two pairs of temperatures can be measured.

1. Display the OTHER page of the TEMP window.
   Press [Menu] key → TEMP key → OTHER tab.

2. Select the temperatures in the <ΔT SITES> and <ΔT2 SITES> boxes.
   i) Touch the first temperature in the <ΔT SITES> or <ΔT2 SITES> box and select a temperature from the <SELECTABLE ITEMS> box.
   ii) Touch the second temperature in the <ΔT SITES> or <ΔT2 SITES> box and select a temperature from the <SELECTABLE ITEMS> box.

   If you do not need to monitor temperature difference, select NONE in the <ΔT SITES> or <ΔT2 SITES> box.

   The difference between the temperatures is calculated and appears in the home screen.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
LABEL
OTHER
SELECTABLE ITEMS
ΔT SITES
T1
-
T2
ΔT2 SITES
T3
-
T4
T1
Tskin
Tcore
Tblad
T2
Tskin2
Tnaso
Taxil
T3
Tskin3
Teso
Tb
T4
Trect
Ttymp
NONE
First temperature
Second temperature

3. Press the [Home] key to return to the home screen.

Changing the Temperature Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

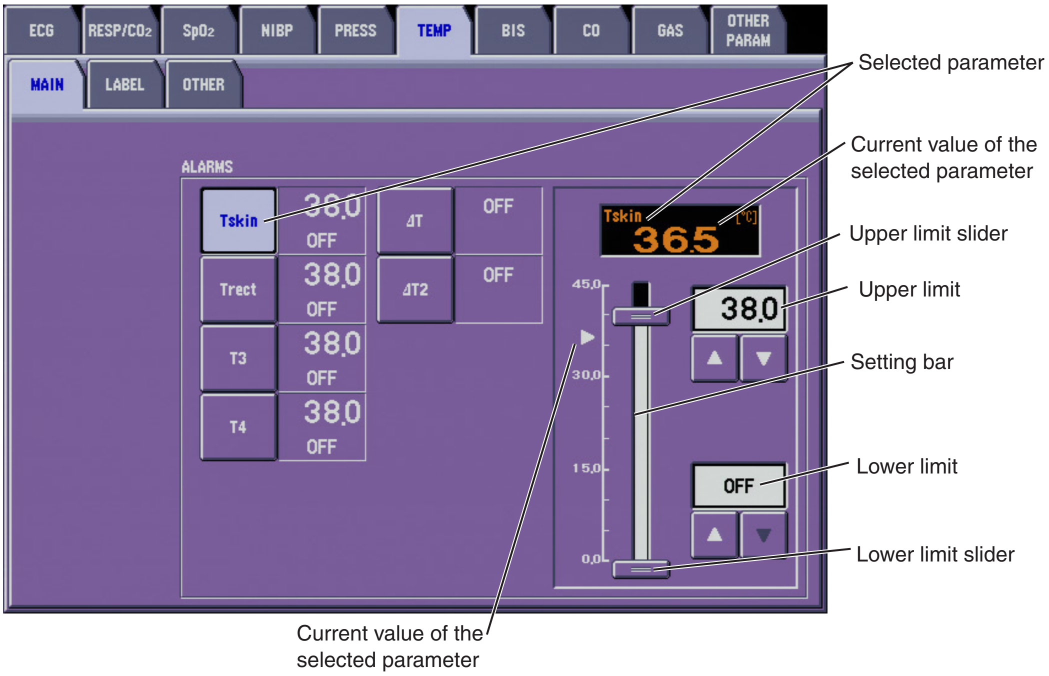
You can set the upper and lower temperature alarm limits on the TEMP window. You can set all alarms, including the upper and lower temperature alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

Setting Range

Temperature upper limit:	0.1 to 45.0°C in 0.1°C steps (33 to 113°F in 1°F steps), OFF (default setting: OR/ICU: 38.0°C (100°F), NICU: 39.0°C (102°F))
Temperature lower limit:	OFF, 0.0 to 44.9 in 0.1°C steps (32 to 112°F in 1°F steps) (default setting: OFF)
ΔTemperature upper limit:	0.1 to 45.0°C in 0.1°C steps (1.0 to 113°F in 1°F steps), OFF (default setting: OFF)

1. Display the MAIN page of the TEMP window.
   Press [Menu] key → TEMP key → MAIN tab.

2. Touch the parameter key for the alarm limit to be set.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
LABEL
OTHER
ALARMS
Tskin
38.0
OFF
Trect
38.0
OFF
T3
38.0
OFF
T4
38.0
OFF
ΔT
OFF
ΔT2
OFF
Tskin
[°C]
36.5
45.0
30.0
15.0
0.0
38.0
OFF
Selected parameter
Current value of the selected parameter
Upper limit slider
Upper limit
Setting bar
Lower limit
Lower limit slider
Current value of the selected parameter

3. Touch and drag the slider to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

Section 8 BIS Monitoring

General 8.2
    List of Terms 8.2
Preparing for BIS Monitoring 8.3
    Preparation Flowchart for Using the BIS Processor 8.3
    Preparation Flowchart for Using the BIS Monitor 8.4
Monitoring BIS 8.5
    BIS Information on the Home Screen 8.8
    BIS Information on the BIS Window 8.9
Changing the BIS Settings 8.10
    Checking the Impedance of the BIS Sensor 8.10
        Automatically Checking Impedance 8.11
        Manually Checking Impedance 8.11
    Changing the BIS Alarm Limits 8.12
    Changing the Sensitivity 8.13
    Turning the Filter On or Off 8.13
    Selecting the BIS Average Time (Smoothing Rate) 8.14
    Changing the EEG Waveform Sweep Speed 8.14
    Selecting the Second Current Trendgraph 8.15

General

BIS monitoring can be performed by using the BISx processor or BIS monitor manufactured by Aspect Medical Systems.

The BISx processor is also available from Nihon Kohden as the QE-910P BIS processor.

To use the QE-910P BIS processor (or BISx processor), the YJ-671P BISx connection cable is required. The BISx connection cable can only be connected to the MULTI socket on the AY-600P series input unit, AA-672P/AA-674P smart expansion unit or JA-694PA data acquisition unit.

To connect the BIS monitor to the bedside monitor, the QF-902P interface is required.

NOTE

BIS cannot be monitored by connecting the BISx connection cable to the MULTI socket on the AY-660P input unit.

List of Terms

Term	Description	Measuring Range
BIS	Bispectral index Indicates the effects of anesthetic agents on the brain.	0 to 100 (1 steps)
EMG	Electromyogram Indicates the effects of EMG on the EEG signal. This shows the high frequency artifact in the input signal.	30.0 to 55.0 dB
SEF	95% spectral edge frequency Shows the level of hypnosis. (The frequency below which the power spectrum contains 95% of the total power in the EEG.)	0.5 to 30.0 Hz (0.5 Hz steps)
SQI	Signal quality index Shows the level of the EEG signal quality. This is the percentage of interval with no artifact in the EEG signal.	0 to 100%
SR	Suppression ratio The percentage of epochs in the past 63 seconds in which the EEG signal is considered to be suppressed for more than 0.5 second.	0 to 100%
BCOUNT*	Burst count The number of EEG bursts in the last minute. Blanked if SR is less than 5. Activated by connection of an Extend sensor.	0 to 30
EEG	A visual representation of the rhythmic fluctuations of electric potential between parts of the brain (brain waves).	—

* This parameter in only available when using BIS processor or BISx proccessor.

Preparing for BIS Monitoring

CAUTION

Only use the specified BIS sensor.

CAUTION

When attaching the BIS sensor to the patient, press each electrode on the sensor for 5 seconds to reduce impedance between the electrode and skin.

CAUTION

Do not use an expired BIS sensor.

CAUTION

To minimize the risk of patient strangulation, the PIC Plus patient interface cable must be carefully placed and secured.

CAUTION

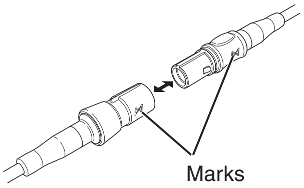
- The BIS sensor is single use only. Do not reuse it.
- Do not reuse the BIS sensor for another patient. There are a lot of fine projections on the BIS sensor. Reusing the BIS sensor for another patient may cause infection to another patient by bacteria adhering to the BIS sensor.
- Do not use the BIS sensor for more than 24 hours. It affects monitoring accuracy.

CAUTION

The BIS processor cannot be sterilized. Sterilizing the BIS processor may damage it.

Preparation Flowchart for Using the BIS Processor

1. Connect the BSM connector of the BIS processor or BISx processor to the BISx connection cable by aligning the marks on each connector until you hear a click.



2. Connect the BISx connection cable to the MULTI socket on the unit.

3. Connect the BIS sensor to the PIC Plus patient interface cable and connect the interface cable to the BIS processor.

4. Attach the BIS sensor to the patient.

5. Start measurement and change necessary settings.

For steps 3 and 4, refer to the BIS processor operator’s manual.

Preparation Flowchart for Using the BIS Monitor

1. Set up the BIS monitor and connect it to the bedside monitor. Refer to the QF-902P interface manual.

2. Connect the BIS monitor to the patient. Refer to the BIS monitor manual.

3. Start measurement and change necessary settings.

Monitoring BIS

After completing the preparation, BIS data and the EEG waveform appear on the screen.

General Safety Information for Using BIS Processor

WARNING

Do not perform defibrillation with the BIS sensor placed between the defibrillator pads.

WARNING

Reliance on the BIS alone for intraoperative anesthetic management is not recommended. Clinical judgement (patient face color, patient reaction, heart rate, blood pressure and other vital sign data) should always be used. BIS has been studied with the anesthetic agents listed in the “Drugs that have been Studied for Use with the BIS” section in the BIS reference guide, but the studied data are relative values and do not indicate the absolute value of the hypnotic level.

WARNING

The hypnotic state of a patient undergoing surgery is influenced by the intensity of stimulation that is applied. During the course of a surgical procedure, the balance between the intensity of stimulation and sensory suppression may be constantly changing. Read the BIS value carefully.

WARNING

Due to limited clinical experience in the following applications, BIS values should be interpreted cautiously in patients with known neurological disorders such as epilepsy, patients taking other psychoactive medications, patients with cerebral infarction and in children below the age of 18.

WARNING

The conductive parts of electrodes or sensor and connectors, including the neutral electrode, should not contact other conductive parts, including earth.

WARNING

Do not place the BIS monitor or BIS processor above the patient. When installing the BIS monitor, use the pole clamp to firmly attach the BIS monitor to a secure pole (1.0 to 3.8 cm in diameter). Periodically check that the pole clamp knob is not loose. Use the clip on the back of the BIS processor to attach the BIS processor to the bed rail or pole. If the BIS monitor or BIS processor is not attached to a rail or pole, install it where it cannot fall or tip over. Otherwise, it may cause injury to the patient or operator.

WARNING

It is reported that BIS monitoring is not appropriate when an analgesic anesthetic agent, such as ketamin, fentanyl, morphine, or only a muscle relaxant is used.

CAUTION

Turn off the automatic impedance check if the impedance check signal (1 nA, 128 Hz) interferes with other equipment.

CAUTION

Do not let the BIS processor continuously contact the patient's body. The BIS processor heats up during operation and it may cause low temperature burn to the patient.

CAUTION

When performing electroconvulsive therapy (ETC), attach the BIS sensor as far as possible from the electrodes that are used for electrical shock. Otherwise noise from the electrodes may interfere and incorrect data is displayed on the screen.

CAUTION

When the “BIS CONNECTOR OFF” message is displayed, check that the BIS processor is firmly connected to the connection cable and connection cable is firmly connected to the monitor. The BIS cannot be monitored and the alarm does not function while this message is displayed.

CAUTION

- The following physiological factors and external factors must be considered in BIS monitoring.
  1. Ischemia or hypoxia, when severe enough to cause global EEG slowing or outright suppression, results in a decrease in the BIS value. It is important to bear in mind that the frontal montage used for BIS monitoring usually will not detect episodes of focal ischemia caused by embolic events.
  2. Hypothermia will generally result in a corresponding decrease in BIS levels as brain processes slow. More profound hypothermia used during cardiac bypass procedures will cause suppression of the EEG and, consequently, a very low BIS.
  3. Artifacts and signal of poor quality cause the BIS to be unreliable. Such artifacts are caused by poor contact of sensor to skin, muscle activity or rigidity, head or body movement, eye movement, inappropriate sensor attachment and other electrical interference. Some examples are given below.
     a) Hum noise: Usually there is no hum interference, but when the hum filter is turned off and a signal larger than 100 μV is superimposed on the EEG waveform on the screen, BIS may increase.
     b) ESU (unipolar):The noise generated by unipolar ESU is so large that it saturates the EEG signal so that EEG waveforms cannot be acquired. BIS value first blinks (SQI decreases) and then disappears. After stopping the use of the ESU, BIS value is displayed again.
     c) ESU (bipolar): Bipolar ESU causes low amplitude high frequency wave signals which may be mistaken as EEG and thus cause an increase in BIS value. If there is unexpected increase in BIS, monitor EEG carefully and read the BIS value carefully.
     d) ECG: The BIS processor has a filter for detecting ECG, but large ECG may be mistaken as EEG. If ECG artifact is seen on the EEG, read the BIS value carefully.
     e) Pulse wave: There may be an interference caused by the pulse wave when the BIS sensor is attached near an artery. Reattach the BIS sensor to the appropriate site.
     f) Pacemaker: If pacing spikes can be seen on the EEG, the BIS may be affected. Read the BIS value carefully.
     g) EMG: EMG is a signal of high frequency wave of more than 500 μV (generally more than 30 Hz). There is an increase in EMG as the patient is emerging from anesthesia. Muscle activity is seen during surgery. The BIS processor has a filter for detecting EMG, but the increase in EMG causes an increase in the BIS value. Shivering in a patient who is emerging from anesthesia may increase EMG and artifact on EEG, resulting in an increase in BIS value.
- Check the BIS sensor attachment when there is an unexpected EMG increase and SQI decrease. If EMG still increases after having checked the sensor attachment, there may be an electromagnetic interference. Check the surrounding equipment and power supply.

NOTE

Connect the BIS connector of the BIS processor or BISx processor until you hear a click.

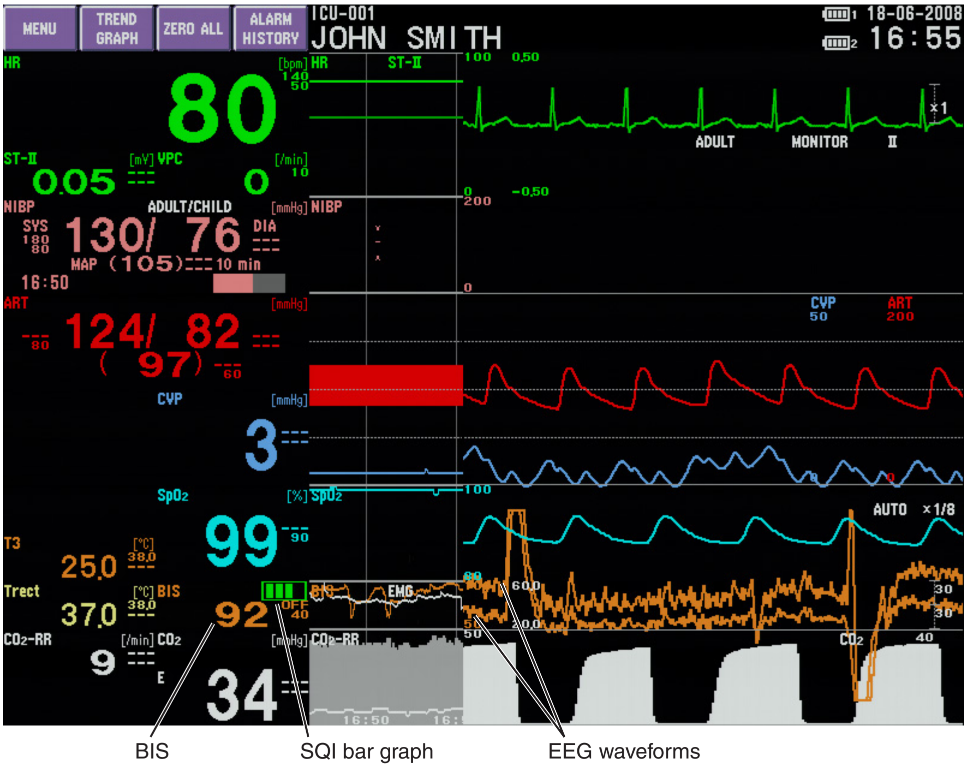
Safety Information for Using BIS Monitor

WARNING

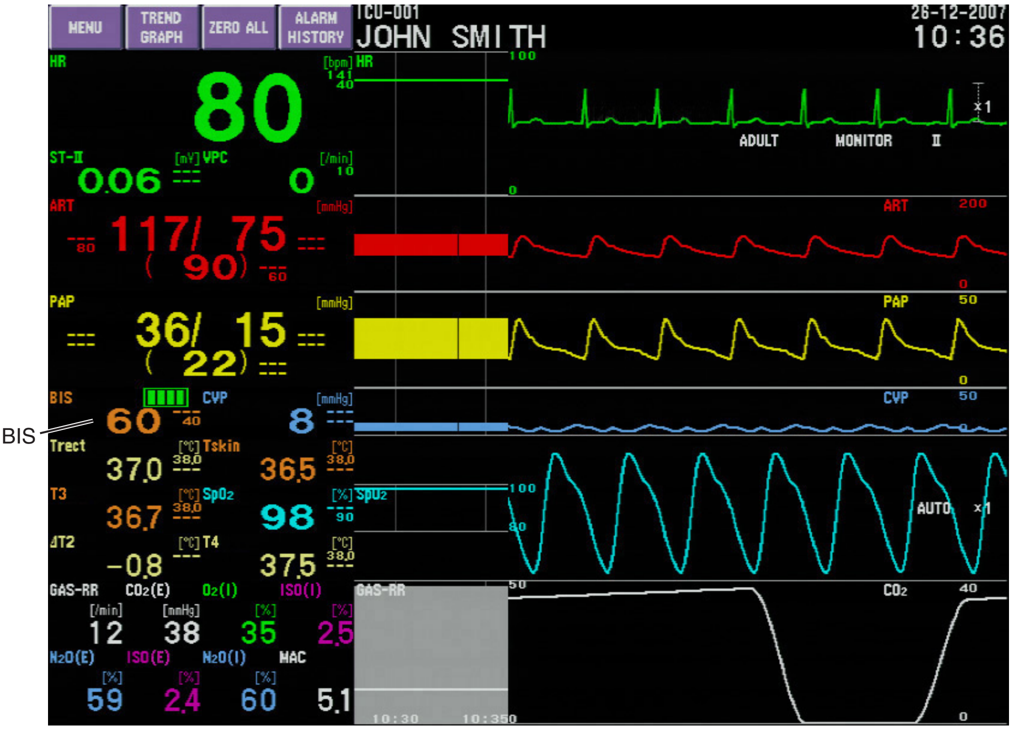
The BIS monitor alarms do not function on the bedside monitor. When the BIS data on the bedside monitor is abnormal, check the alarm on the BIS monitor.

BIS Information on the Home Screen

Using the BIS Processor

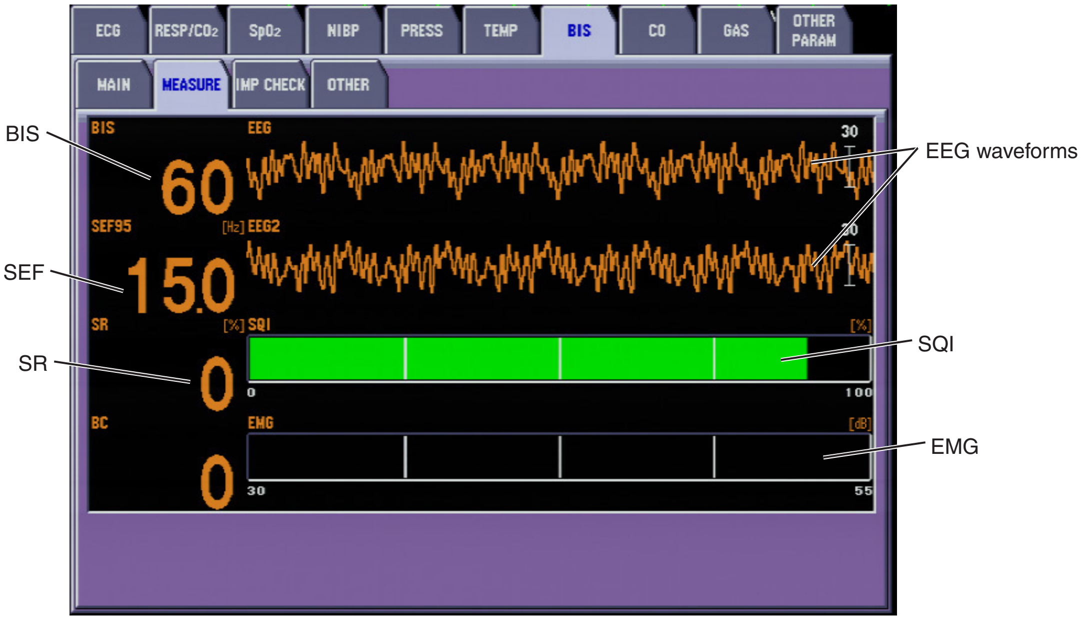

BIS
SQI bar graph
EEG waveforms

Using the BIS Monitor

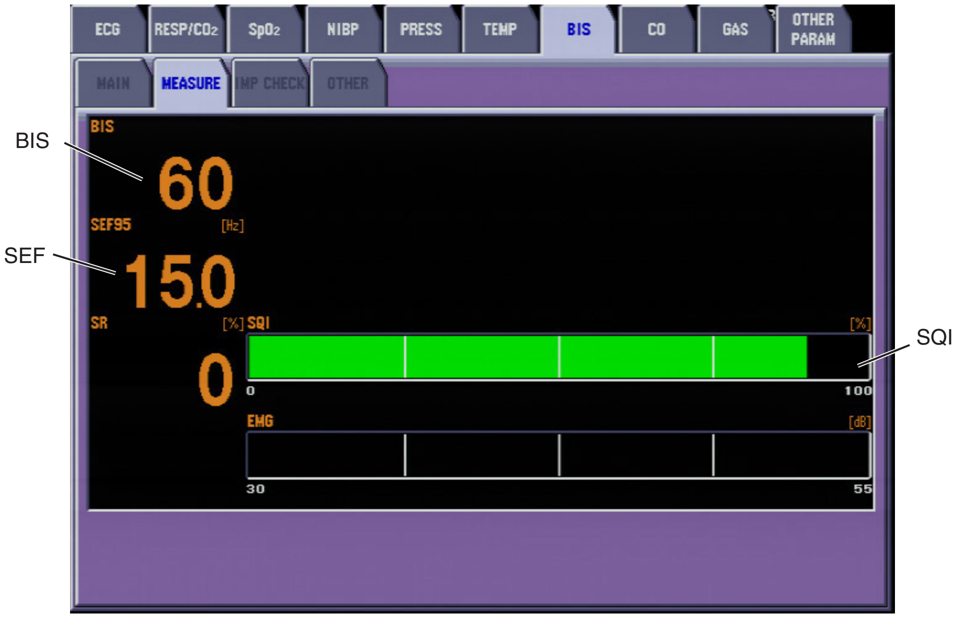


BIS Information on the BIS Window

Using the BIS Processor


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
BIS
60
EEG
30
SEF95
[Hz]
150
EEG2
SR
[%]
0
SQI
[%]
0
100
BC
0
EMG
[dB]
30
55
BIS
SEF
SR
EEG waveforms
SQI
EMG

Using the BIS Monitor


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
BIS
60
SEF95
[Hz]
150
SR
[%]
0
SQI
[%]
0
100
EMG
[dB]
30
55
BIS
SEF
SQI

Changing the BIS Settings

When using the BIS processor, the following settings can be changed for BIS monitoring. Change the settings on the BIS window.

- BIS alarm limits
- BIS waveform sensitivity
- Check impedance and auto impedance check on or off
- Filter on or off
- Smoothing rate
- BIS waveform sweep speed
- Parameter for second current trendgraph

The display color for BIS can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

When using the BIS monitor, only the measured values are displayed on the bedside monitor screen.

The waveform display of the EEG and EEG2 on the home screen can be selected on the DISPLAY window. Refer to Section 3 of the User's Guide Part I.

Checking the Impedance of the BIS Sensor

This setting is not available when using the BIS monitor.

Check the impedance between the BIS sensor and skin. If the check result is not "PASS", remove the cause and repeat the impedance check until the result becomes "PASS".

The impedance check can be performed automatically and manually.

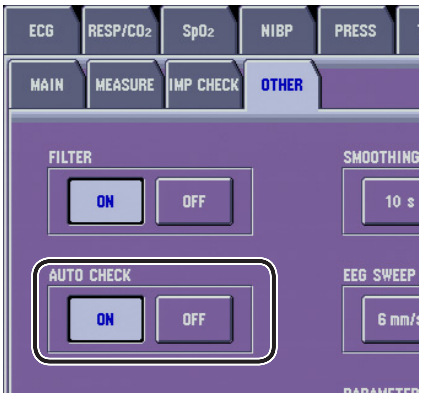
PASS:	The impedance check is OK. The impedance is 7.5 kΩ or less. However, the result of the #2 ground electrode becomes "PASS" when the impedance is 100 kΩ or less.
HIGH:	The impedance is above 7.5 kΩ. As long as the sum of the impedance of all electrodes except for the ground electrode is 15 kΩ or less, the check result becomes "PASS". If the check result is over 15 kΩ, clean the skin where the BIS sensor will be attached.
NOISE:	The signal from the electrode exceeds the measurable range. Check the BIS sensor attachment. Replace the BIS sensor with a new one if necessary.
LDOFF:	Connector connection is loose or disconnected. Check the connection from the BIS sensor to the bedside monitor. If necessary, replace the BIS sensor or PIC Plus patient interface cable with a new one.

Automatically Checking Impedance

When auto check is turned ON, the impedance is checked every 10 minutes.

CAUTION

Turn off the automatic impedance check if the impedance check signal (1 nA, 128 Hz) interferes with other equipment.


ECG
RESP/CO2
SpO2
NIBP
PRESS
MAIN
MEASURE
IMP CHECK
OTHER
FILTER
ON
OFF
SMOOTHING
10 s
AUTO CHECK
ON
OFF
EEG SWEEP
6 mm/s

If the result is not "PASS", the "CHECK SENSOR" message appears on the screen.

1. Display the OTHER page on the BIS window.
   Press [Menu] key → BIS key → OTHER tab.

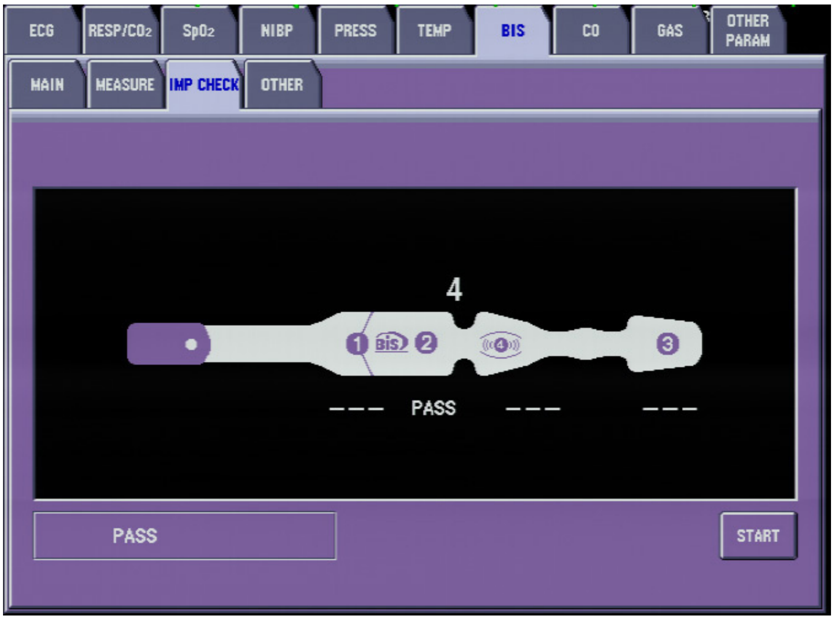
2. Touch the ON key in the <AUTO CHECK> box.

3. Press the [Home] key to return to the home screen.

Manually Checking Impedance

1. Display the IMP CHECK page on the BIS window.
   Press [Menu] key → BIS key → IMP CHECK tab.

2. Touch the START key.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
4
1
BIS
2
4
3

PASS

START

PASS

   The check result appears.

3. Press the [Home] key to return to the home screen.

Changing the BIS Alarm Limits

This setting is not available when using the BIS monitor.

> **CAUTION**
>
> When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower BIS alarm limits on the BIS window. You can set all alarms, including the upper and lower BIS alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

Setting Range

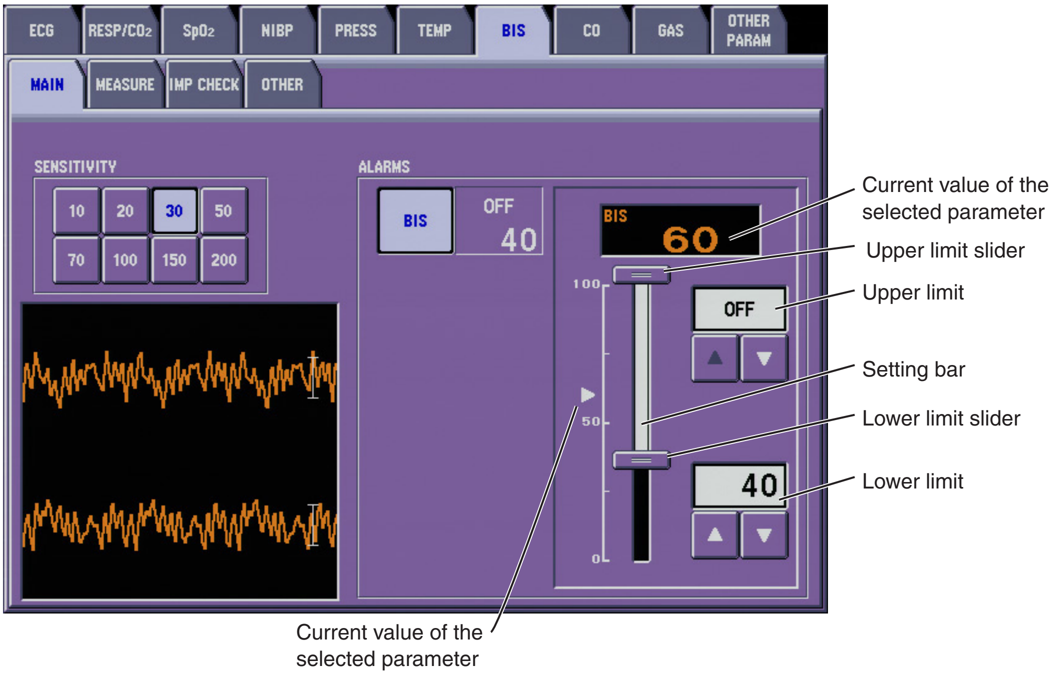
BIS upper limit: 1 to 100 in 1 steps, OFF (default setting: OFF)

BIS lower limit: OFF, 0 to 99 in 1 steps (default setting: 40)

1. Display the MAIN page on the BIS window.
   Press [Menu] key → BIS key → MAIN tab.

2. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
SENSITIVITY
10
20
30
50
70
100
150
200
ALARMS
BIS
OFF
40
BIS
60
100
50
0
OFF
40
Current value of the selected parameter
Upper limit slider
Upper limit
Setting bar
Lower limit slider
Lower limit
Current value of the selected parameter

3. Press the [Home] key to return to the home screen.

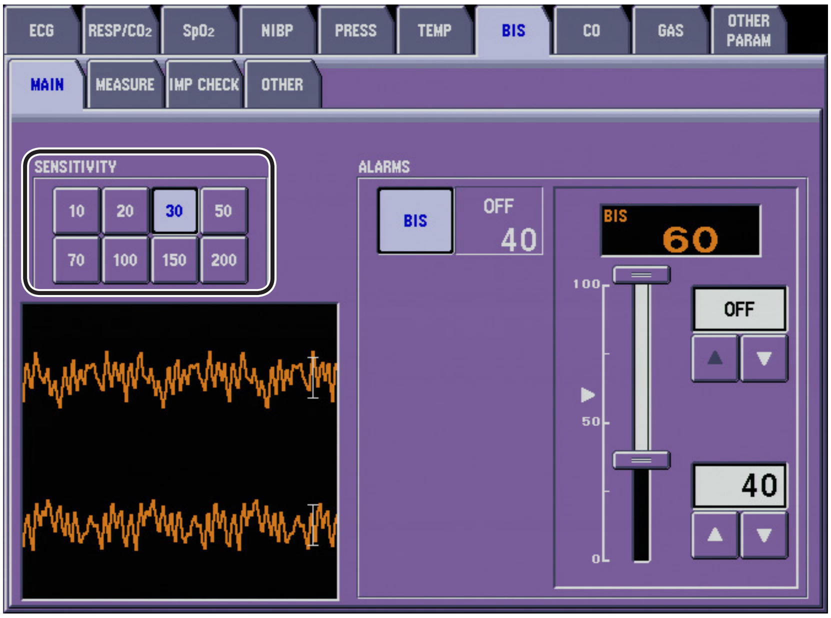
Changing the Sensitivity

This setting is not available when using the BIS monitor.

The sensitivity determines the size of the BIS waveform on both the screen and recording paper.

1. Display the MAIN page on the BIS window.
   Press [Menu] key → BIS key → MAIN tab.

2. Select the sensitivity from the <SENSITIVITY> box (unit: µV/div).


ECG
RESP/CO₂
SpO₂
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
SENSITIVITY
10
20
30
50
70
100
150
200
ALARMS
BIS
OFF
40
BIS
60
100
50
0
OFF
40

3. Press the [Home] key to return to the home screen.

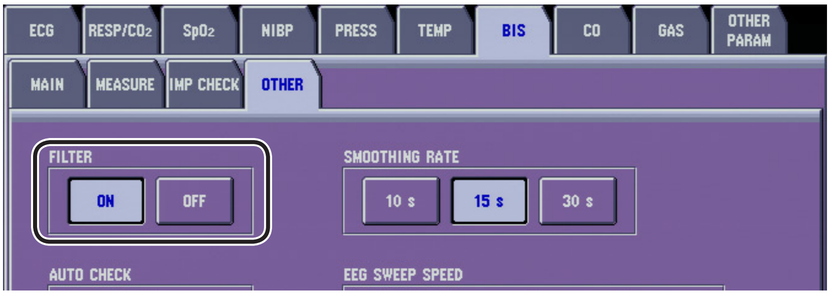
Turning the Filter On or Off

This setting is not available when using the BIS monitor.

Turn the high-cut filter, low-cut filter and AC filter on or off. This setting is applied on both the home screen and BIS window.

1. Display the OTHER page on the BIS window.
   Press [Menu] key → BIS key → OTHER tab.

2. Select ON or OFF in the <FILTER> box.


ECG
RESP/CO₂
SpO₂
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
FILTER
ON
OFF
SMOOTHING RATE
10 s
15 s
30 s
AUTO CHECK
EEG SWEEP SPEED

3. Press the [Home] key to return to the home screen.

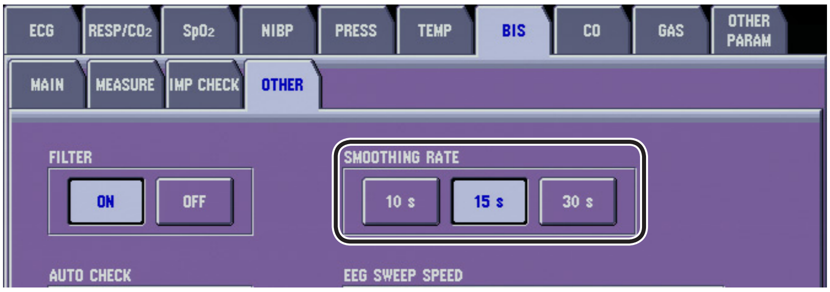
Selecting the BIS Average Time (Smoothing Rate)

This setting is not available when using the BIS monitor.

Select the BIS smoothing rate over which the BIS value is averaged.

1. Display the OTHER page on the BIS window.
   Press [Menu] key → BIS key → OTHER tab.

2. Select the smoothing rate in the <SMOOTHING RATE> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
FILTER
ON
OFF
SMOOTHING RATE
10 s
15 s
30 s
AUTO CHECK
EEG SWEEP SPEED

3. Press the [Home] key to return to the home screen.

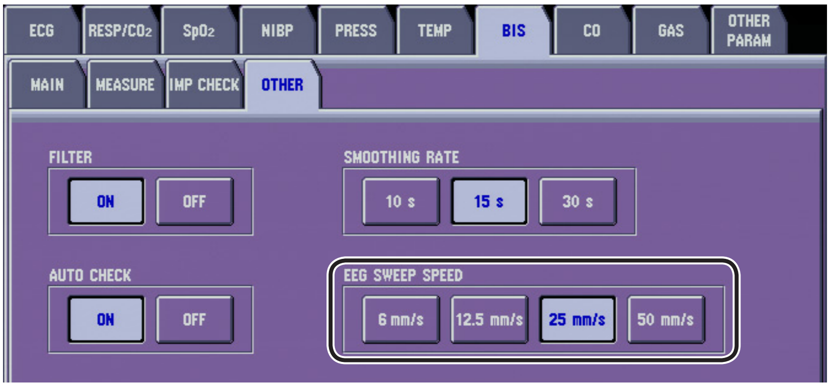
Changing the EEG Waveform Sweep Speed

This setting is not available when using the BIS monitor.

The sweep speed of the EEG waveform on the home screen can be changed.

1. Display the OTHER page on the BIS window.
   Press [Menu] key → BIS key → OTHER tab.

2. Select the appropriate speed in the <EEG SWEEP SPEED> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MAIN
MEASURE
IMP CHECK
OTHER
FILTER
ON
OFF
SMOOTHING RATE
10 s
15 s
30 s
AUTO CHECK
ON
OFF
EEG SWEEP SPEED
6 mm/s
12.5 mm/s
25 mm/s
50 mm/s

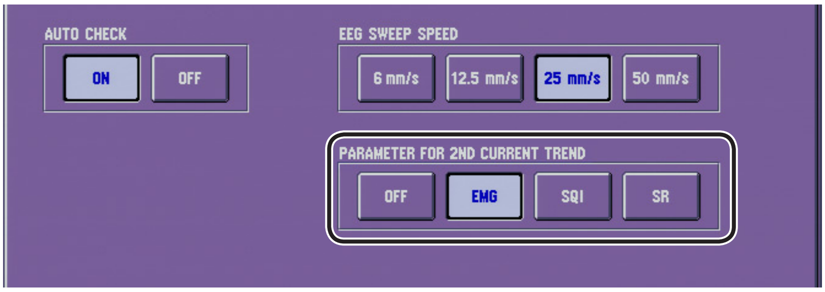
3. Press the [Home] key to return to the home screen.

Selecting the Second Current Trendgraph

Select the second parameter to be displayed as a trendgraph on the home screen. The second trendgraph is displayed in white.

1. Display the OTHER page on the BIS window.
   Press [Menu] key → BIS key → OTHER tab.

2. Select the parameter in the <PARAMETER FOR 2ND CURRENT TREND> box. Select OFF when the second trendgraph is not needed.


AUTO CHECK
ON
OFF
EEG SWEEP SPEED
6 mm/s
12.5 mm/s
25 mm/s
50 mm/s
PARAMETER FOR 2ND CURRENT TREND
OFF
EMG
SQI
SR

3. Press the [Home] key to return to the home screen.

Section 9 Cardiac Output Monitoring

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General

CO (Cardiac Output) measurement is performed by connecting the measuring system to the MULTI socket on the unit. This monitor uses the thermodilution method.

NOTE

CO cannot be monitored by using the MULTI socket on the AY-660P input unit.

Thermodilution method

This method is performed by injecting cold water into the right atrium, measuring the temperature changes of the blood after mixing of the injected cold water in the right ventricle using the thermistor at the tip of a catheter, and drawing the temperature change curve (thermal dilution curve). The cardiac output is calculated from the area below this curve.

WARNING

When performing defibrillation during cardiac output monitoring, never touch the CO connection cord. The discharged energy may cause electrical shock or injury.

NOTE

CO monitoring using the MULTI socket does not comply with the Defibrillator proof type CF.

Preparing for Cardiac Output Monitoring

Preparation Flowchart

1. Select the thermodilution catheter.

2. Prepare the injectate.

3. Connect the catheter to the CO connection cord, connect the CO connection cord to the MULTI socket on the unit, and assemble the measuring system. For details, refer to the instruction manuals provided with the catheter and measuring system.

4. Insert the catheter into the patient.

5. Measure the pulmonary capillary wedge pressure. Determine the position for retaining the catheter.

6. Check the setting for measuring CO.

7. Start monitoring CO.

Selecting the Catheter

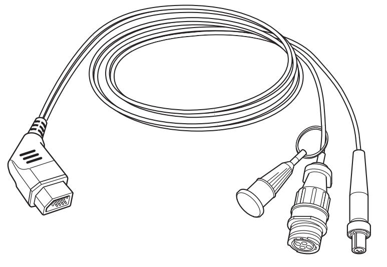
Select the appropriate catheter according to the purpose.

CAUTION

Do not reuse disposable parts and accessories.

Types of Catheter

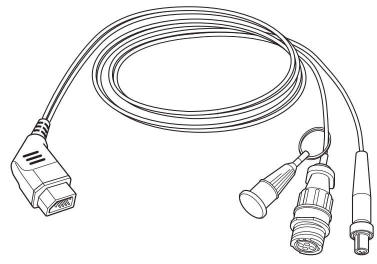
Becton Dickinson Thermodilution Catheter

Catheter	Specifications	Thickness (F)	Lumen	CO Connection Cord
TC-504*	—	5	4	JT-950P 
TC-664MP*	Made of polyurethane	6		
TC-704*	—	7		
TC-704M*				
TC-704MU*	Made of polyurethane			
TC-7042*	For inline sensor method			
TC-755*	—	7.5	5	
TC-774MP*	Made of polyurethane	7	4	

* These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

Edwards Lifesciences (Baxter) Swan-Ganz (Thermodilution) Catheter

Edwards Lifesciences (Baxter) catheters are available direct from Edwards Lifesciences (Baxter) (www.edwards.com) or their suppliers.

Catheter	Specifications	Thickness (F)	Lumen	CO Connection Cord
131H-7F*[1]	Standard	7	4	JT-950P 
141H-7F*[1]	Hard			
151H-7F*[1]	For femoral vein			
93A-161H-7F*[1]*[2]	Hard tapered			
93A-171H-7F*[1]*[2]	Torque support			
93C-172H-7F*[1]*[2]	Made of polyurethane			
096-6F*[1]*[2]	For adult small blood vessel	6		
132-5F*[1]*[2]	For children	5		
93A-831H-7.5F*[1]*[2]	With side hole for infusion	7.5	5	
93A-931H-7.5F*[1]*[2]	With RV pace port side hole			
93A-991H-8F*[1]*[2]	With AV pace port side hole	8	6	
93A-200H-7F*[1]	RA, RV pacing electrode	7	4	
93A-205H-7F*[1]				
93A-741H-7.5F*[1]	$S\bar{v}O_2$ measurement possible.*[3]	7.5	5	

*[1] These parts have not been checked for compliance with the MDD (Medical Device Directive). For EC member countries, Nihon Kohden recommends the use of parts that comply with MDD.

*[2] In this monitor, the computation constant required for calculating CO value is automatically calculated, but not for the catheters marked with *[2]. When using these catheters, enter the computation constant labeled on the package of the catheter.

*[3] $S\bar{v}O_2$ cannot be monitored on this bedside monitor.

Preparing the Injectate

Usable Injectate

Use sterilized 5% glucose solution for the injectate. Physiological saline can also be used, but the CO value is about 2% lower than when glucose is used.

Injectate Temperature and Volume

When the injectate temperature is high or the injectate volume is small, the thermodilution curve becomes low and the measuring range is limited. Use a large volume (10 cc) of low temperature (0°C, 32°F) injectate if it does not cause any problems to the patient.

The appropriate injectate temperature and volume differs according to the catheter used. Refer to the instruction manual for the catheter used.

NOTE

When room temperature injectate is used, the change in blood temperature becomes small and the measurement results cannot be used on patients with low cardiac output.

Measuring the Injectate Temperature

Types of Measuring Methods

Measure the injectate temperature using one of the following two methods.

Measuring Type	Measuring Method
Inline sensor method	Directly measures the injectate temperature at injection. The measuring accuracy is high because the temperature is measured directly.
Bath probe method	Measures the injectate temperature before injection and uses this temperature as the injectate temperature.

If the measurement of the injectate temperature is omitted, the monitor assumes the temperature to be 0°C (32°F) and "- - -" is displayed for Ti on the screen. In this case, use injectate that has been cooled down to 0°C (32°F).

NOTE

When drawing injectate into the syringe using the close injection kit or extension tube, always use the inline sensor. If the inline sensor is not used, the injectate temperature rises about 5 to 10°C (41 to 50°F) when passing through the extension tube and the temperature difference between the injectate in the bottle and injected injectate becomes large and the CO result may be higher than the actual value.

Preparing the Injectate

Prepare the injectate according to the following table.

Preparations	Injectate Temperature Measuring Method	Accuracy	Ease of Use	Sterilization	Running Cost
Use a closed injection kit	Inline sensor method	excellent	excellent	excellent	fair
Syringes iced in the container	Inline sensor method	excellent	good	good	fair
	Bath probe method	good	fair	fair	good
	None*	fair	good	good	good
Transfers injectate from iced injectate bottle to syringe	Inline sensor method	excellent	good	good	fair
	None*	good	excellent	good	good

* When the injectate is cooled down to 0°C (32°F).

Inline Sensor Method

When using the inline sensor method, prepare the injectate using one of the following methods.

- Using the close injection kit

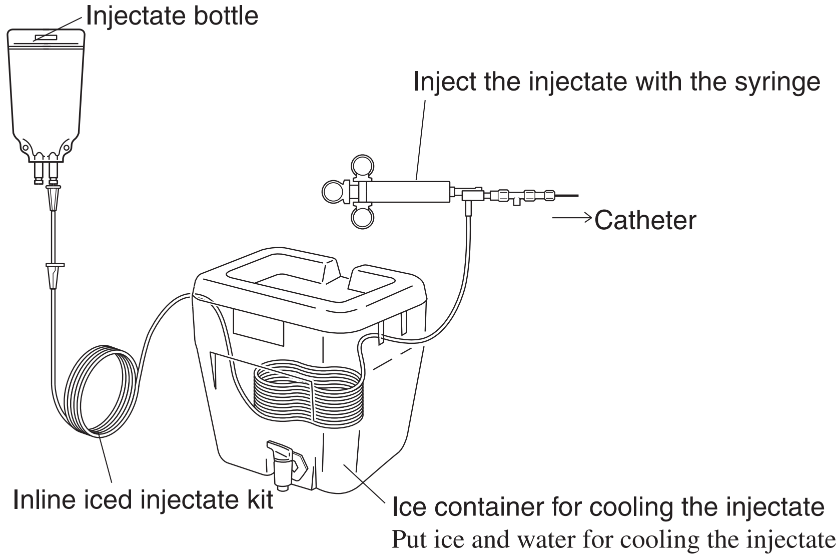
  This method is easy and allows the monitor to determine the temperature of the injectate accurately. Use a close injection kit with a temperature sensor, close the circuit and inject the injectate.

  Features

  1) Sterilization rate is very high because it is disposable and closed
  2) Measurements are accurate
  3) Easy to use (Can measure several times using one syringe)
  4) Both cooled injectate and room temperature injectate can be used and cooling time is short

Example

When using the Becton Dickinson catheter: Inline iced injectate kit (SP-4500)
When using the Edwards Lifesciences (Baxter) catheter: Injectate supply system (93-600, 93-610)


Injectate bottle
Inject the injectate with the syringe
Catheter
Inline iced injectate kit
Ice container for cooling the injectate

Put ice and water for cooling the injectate.

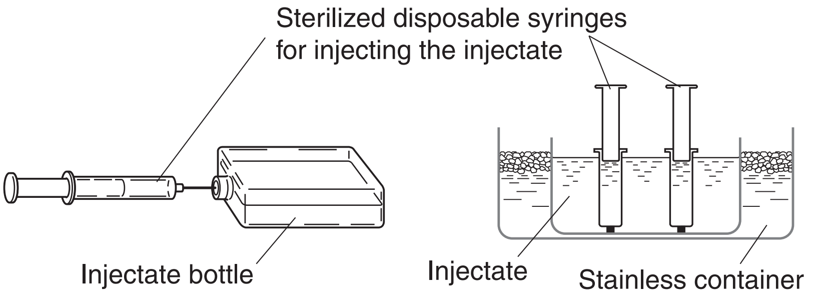
- Drawing directly from the injectate bottle or the container of the injectate

  As shown in the following diagram, draw the injectate directly from its bottle or the container containing the injectate, and inject into the circuit installing the temperature sensor. When drawing injectate from the container, wait about 15 minutes for the temperature of the injectate to reach equilibrium before injecting into the circuit.

  The temperature sensor detects the injectate temperature, and sends the data to the monitor.

  Example

  When using the Becton Dickinson catheter: Inline sensor (SP-5045)
  When using the Edwards Lifesciences (Baxter) catheter: Flow through injectate housing (93-505)


Sterilized disposable syringes for injecting the injectate
Injectate bottle
Injectate
Stainless container

Cool the injectate in the refrigerator if necessary.

For cooling the injectate with ice and water.

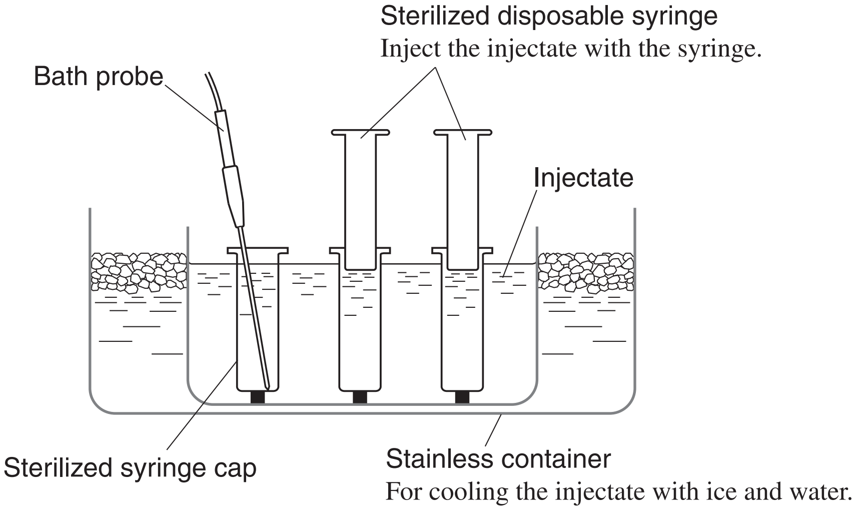
Bath Probe Method

When using the bath probe method, prepare the injectate as follows.

- Drawing the injectate from its container

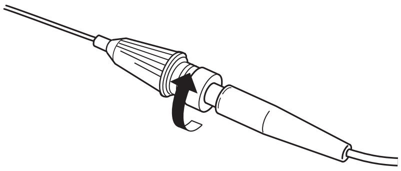
  As shown in the following diagram, draw the injectate from its container and wait about 15 minutes for the injectate temperature to reach equilibrium before injecting it into the circuit.

  Place the thermistor probe (SP-5030) installed in the circuit in the container, and have the monitor determine the injectate temperature.


Sterilized disposable syringe
Inject the injectate with the syringe.
Bath probe
Injectate
Sterilized syringe cap
Stainless container
For cooling the injectate with ice and water.

Assembling the Measuring System

Connecting Cables to the Unit



1. Connect the thermistor connector of the catheter to the CO connection cord and secure it firmly with the ring.
2. Connect the CO connection cord to the MULTI socket on the unit.

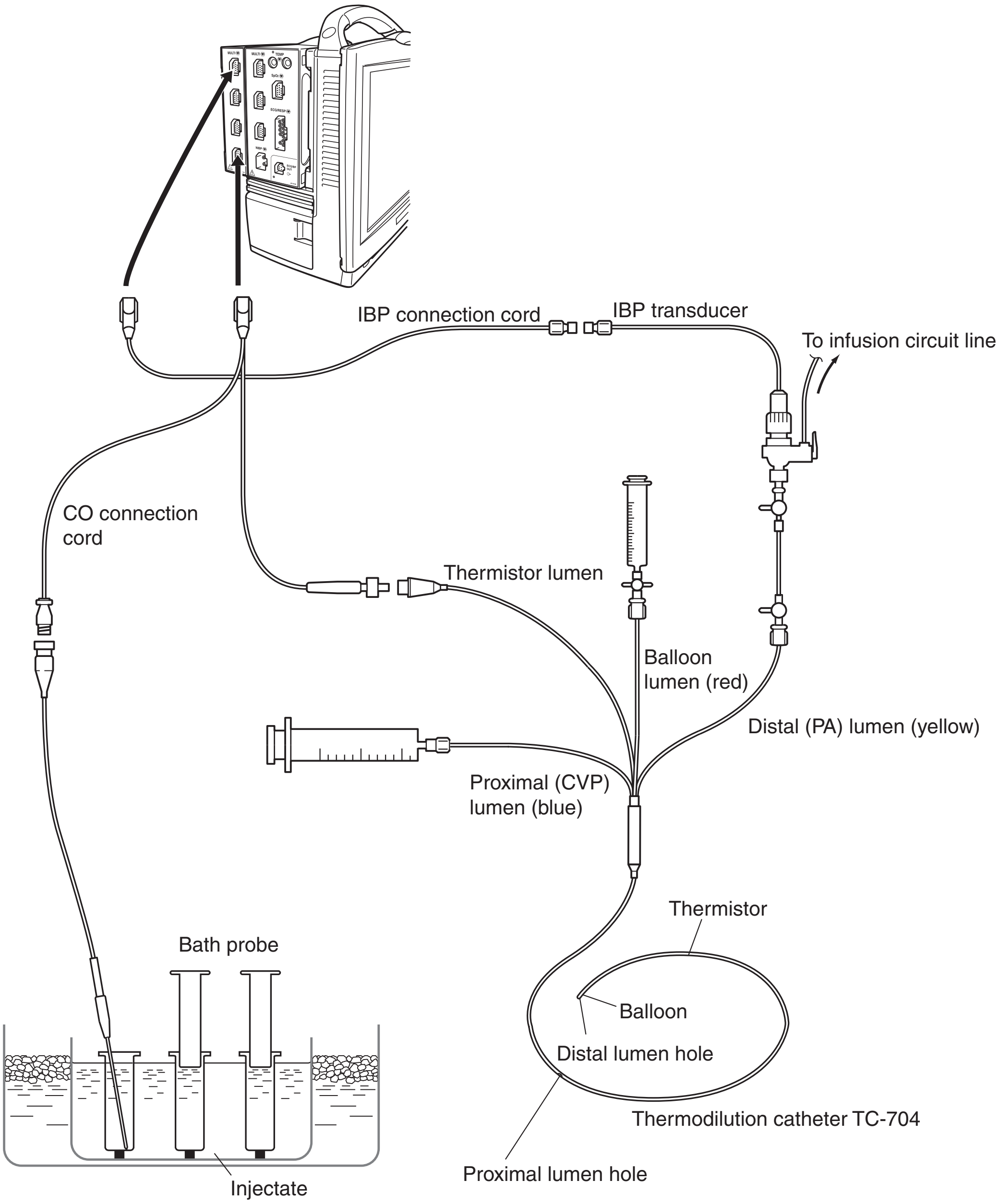
NOTE

CO cannot be monitored by using the MULTI socket on the AY-660P input unit.

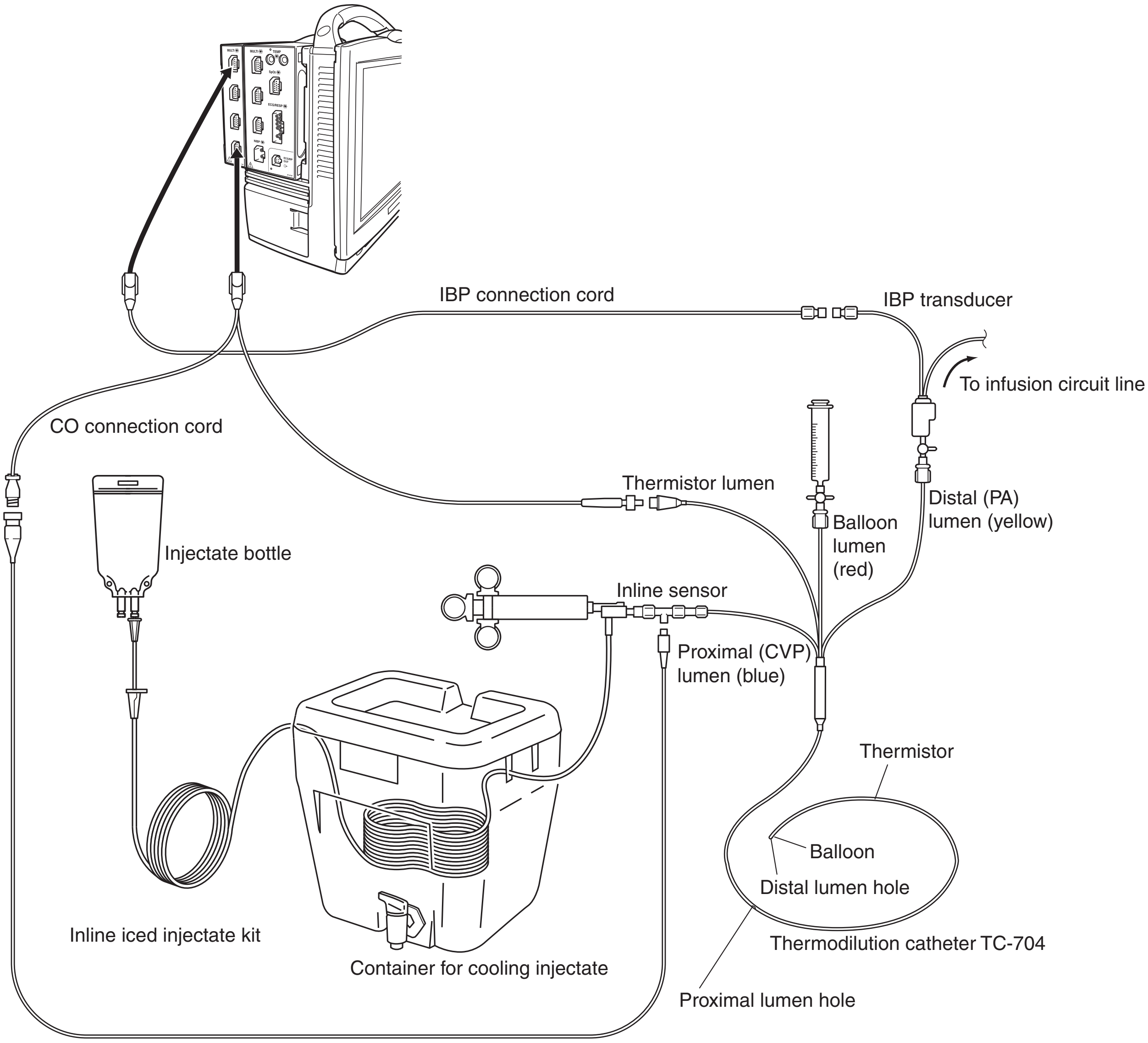
3. Connect the IBP connection cord to the MULTI socket on the unit.

Measuring System Setup Examples

When using the Becton Dickinson Catheter TC-704 and measuring with the bath probe method


IBP connection cord
IBP transducer
To infusion circuit line
CO connection cord
Thermistor lumen
Balloon lumen (red)
Distal (PA) lumen (yellow)
Proximal (CVP) lumen (blue)
Thermistor
Bath probe
Balloon
Distal lumen hole
Thermodilution catheter TC-704
Proximal lumen hole
Injectate

When using the Becton Dickinson Catheter TC-704 and measuring with the inline sensor method


IBP connection cord
IBP transducer
To infusion circuit line
CO connection cord
Thermistor lumen
Balloon lumen (red)
Distal (PA) lumen (yellow)
Injectate bottle
Inline sensor
Proximal (CVP) lumen (blue)
Thermistor
Balloon
Distal lumen hole
Inline iced injectate kit
Container for cooling injectate
Thermodilution catheter TC-704
Proximal lumen hole

Changing Settings for CO Measurement

Before measurements, the coefficient value of the catheter and patient height and weight must be entered. Settings can be changed on the CO window.

NOTE

The settings, such as injectate volume and catheter size are necessary for calculating CO. These settings cannot be changed after measurement.

Setting the Coefficient Value

This monitor automatically calculates the coefficient value from five types of information: the manufacturer of catheter, catheter size, injectate volume, injectate temperature, and method of measuring the injectate temperature.

When using a Becton Dickinson or Edwards Lifesciences (Baxter) catheter, the injectate temperature is automatically measured by this monitor. Enter the manufacturer of catheter, catheter size, injectate volume and injectate temperature as follows. After setting, check that the value is the same as the value on the catheter manual. For a Becton Dickinson catheter, the coefficient values are not specified by the manufacturer for the injectate temperature 5 to 18°C (41.0 to 64.4°F).

When using a catheter other than Becton Dickinson or Edwards Lifesciences (Baxter), enter the computation constant manually. Check the value on the catheter manual.

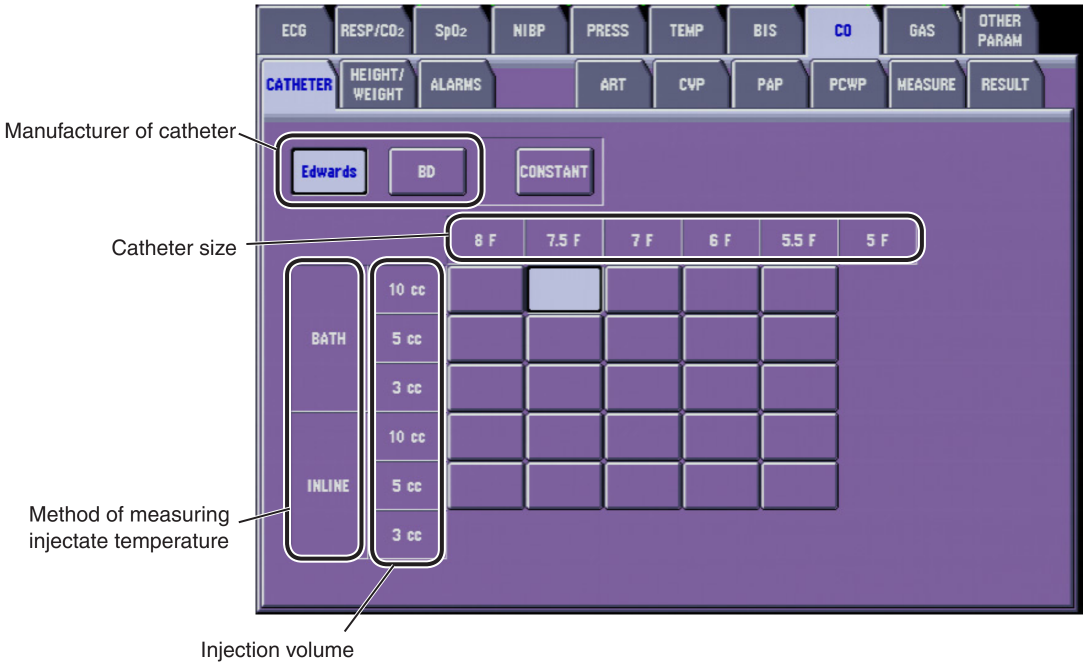
When using a catheter other than bath probe or inline sensor and not setting the injectate temperature on the monitor, select the coefficient value from the bath probe table. In this case, "- - -" is displayed for Ti on the screen.

Procedure

1. Display the CATHETER page of the CO window.
   Press [Menu] key → CO key → CATHETER tab.

2. Select the manufacturer of the catheter (BD or Edwards).

3. Select the areas corresponding to catheter size, method of measuring injectate temperature, and injectate volume.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
Manufacturer of catheter
Edwards
BD
CONSTANT
Catheter size
8 F
7.5 F
7 F
6 F
5.5 F
5 F
BATH
INLINE
10 cc
5 cc
3 cc
10 cc
5 cc
3 cc
Method of measuring injectate temperature
Injection volume

To manually enter coefficient value:

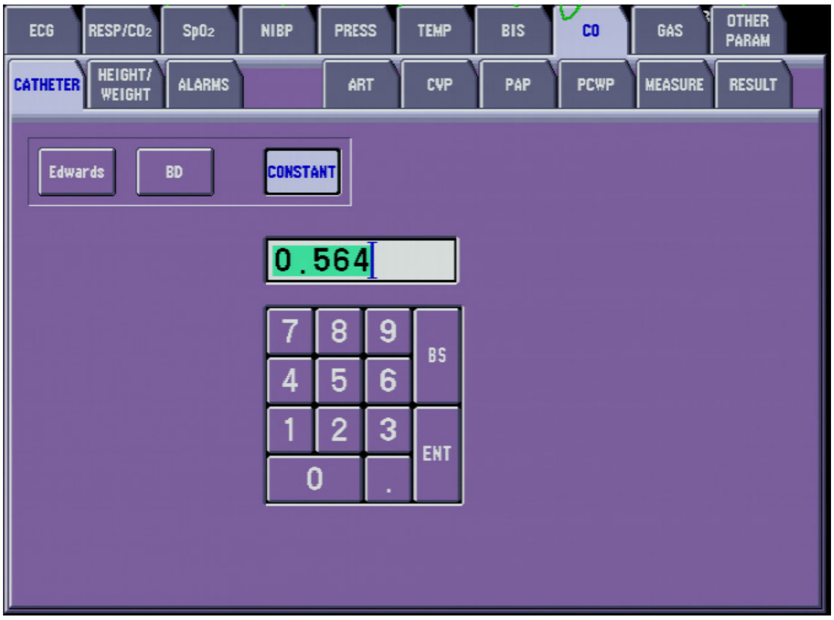
i) Touch the CONSTANT key.

ii) Enter the computation constant with the numeric keys.

iii) Touch the ENT key to register the value. The entered value appears in the box.

NOTE

If the other window is displayed without pressing the ENT key, the entered value is deleted.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
Edwards
BD
CONSTANT
7
8
9
BS
4
5
6
1
2
3
ENT
0
.

0.564

The Preset Coefficient Value Settings

Edwards Lifesciences catheters

Injectate temperature 22.5 to 27°C, 70.5 to 80.6°F

Edwards		**8F**	**7.5F**	**7F**	**6F**	**5.5F**
Bath probe	10 cc	0.612	0.594	0.595	0.607	0.616
	5 cc	0.301	0.283	0.287	0.304	0.304
	3 cc	0.177	0.159	0.165	0.180	0.180
Inline sensor	10 cc	0.601	0.599	0.616	0.616	0.624
	5 cc	0.294	0.301	0.311	0.307	0.310
	3 cc	—	—	—	—	—

Injectate temperature 18 to 22.5°C, 64.4 to 70.5°F

Edwards		**8F**	**7.5F**	**7F**	**6F**	**5.5F**
Bath probe	10 cc	0.588	0.582	0.578	0.597	0.606
	5 cc	0.283	0.277	0.274	0.297	0.298
	3 cc	0.158	0.156	0.154	0.174	0.175
Inline sensor	10 cc	0.593	0.593	0.603	0.602	0.612
	5 cc	0.288	0.297	0.295	0.298	0.304
	3 cc	—	—	—	—	—

Injectate temperature 5 to 18°C, 41 to 64.4°F

Edwards		**8F**	**7.5F**	**7F**	**6F**	**5.5F**
Bath probe	10 cc	0.563	0.575	0.562	0.573	0.581
	5 cc	0.267	0.267	0.262	0.278	0.281
	3 cc	0.148	0.150	0.144	0.159	0.161
Inline sensor	10 cc	0.578	0.578	0.570	0.568	0.581
	5 cc	0.272	0.286	0.257	0.276	0.288
	3 cc	—	—	—	—	—

Injectate temperature 0 to 5°C, 32 to 41°F

Edwards		**8F**	**7.5F**	**7F**	**6F**	**5.5F**
Bath probe	10 cc	0.564	0.564	0.542	0.547	0.555
	5 cc	0.262	0.257	0.247	0.259	0.264
	3 cc	0.139	0.143	0.132	0.144	0.148
Inline sensor	10 cc	0.562	0.563	0.537	0.533	0.549
	5 cc	0.267	0.276	0.217	0.253	0.272
	3 cc	—	—	—	—	—

Becton Dickinson catheters

Injectate temperature 23 to 25°C, 73.4 to 77°F

Becton Dickinson		7.5F	7F	6F	5F
Bath probe	10 cc	0.628	0.628	—	—
	5 cc	0.309	0.309	0.309	0.316
	3 cc	0.181	0.181	0.181	0.188
Inline sensor	10 cc	0.628	0.628	—	—
	5 cc	0.309	0.309	0.309	0.316
	3 cc	0.181	0.181	0.181	0.188

Injectate temperature 18 to 23°C, 64.4 to 73.4°F

Becton Dickinson		7.5F	7F	6F	5F
Bath probe	10 cc	0.628	0.628	—	—
	5 cc	0.309	0.309	0.312	0.312
	3 cc	0.181	0.181	0.184	0.184
Inline sensor	10 cc	0.628	0.628	—	—
	5 cc	0.309	0.309	0.312	0.312
	3 cc	0.181	0.181	0.184	0.184

Injectate temperature 0 to 5°C, 32 to 41°F

Becton Dickinson		7.5F	7F	6F	5F
Bath probe	10 cc	0.566	0.566	—	—
	5 cc	0.270	0.270	0.270	0.279
	3 cc	0.151	0.151	0.151	0.160
Inline sensor	10 cc	0.579	0.579	—	—
	5 cc	0.281	0.281	0.281	0.291
	3 cc	0.160	0.160	0.160	0.170

Changing the Height and Weight

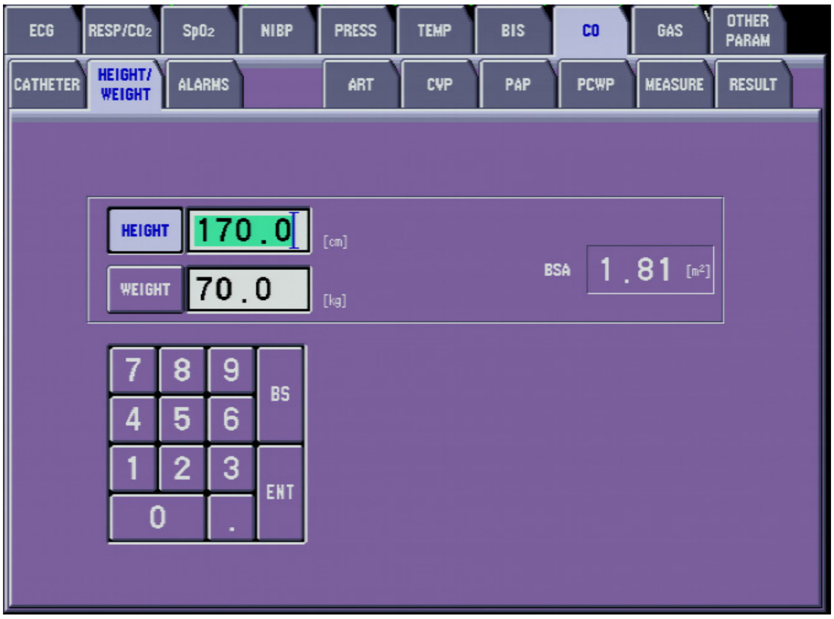
The height and weight data displayed on the CO window are the values entered for the patient information on the ADMIT window. Because this data is used in the calculation of hemodynamics after CO measurement as BSA, check that it is correct before performing CO measurement.

When these values are changed, the settings on the ADMIT window also change.

The units for height (cm or inch) and weight (kg or lbs) can be set on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.

1. Display the HEIGHT/WEIGHT page of the CO window.
   Press [Menu] key → CO key → HEIGHT/WEIGHT tab.

2. Touch the HEIGHT key to change the height.
   Touch the WEIGHT key to change the weight.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
7
8
9
BS
4
5
6
1
2
3
ENT
0
.

HEIGHT 170.0 [cm]
WEIGHT 70.0 [kg]
BSA 1.81 [m²]

3. Enter the value with the numeric keys.

4. Touch the ENT key to register the value. BSA is automatically calculated.

NOTE

If another window is opened before pressing the ENT key, the entered value is deleted.

Changing the Blood Temperature Alarm Setting

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower blood temperature (Tb) alarm limits on the CO window. You can set all alarms, including the upper and lower Tb alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

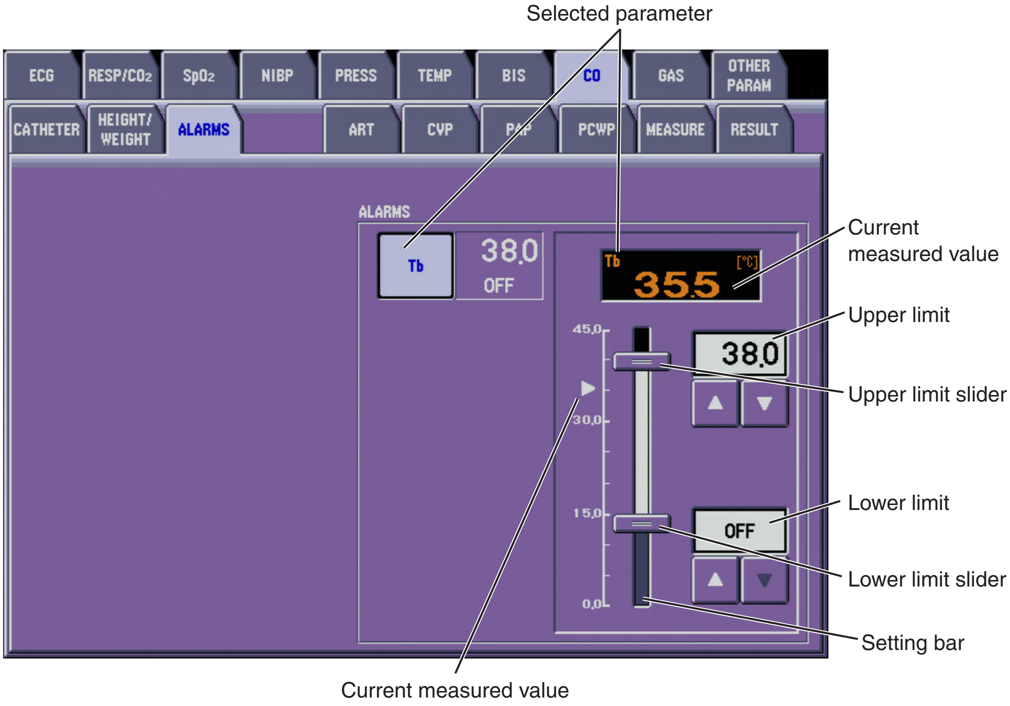
Setting Range

Tb upper limit:	15.1 to 45.0°C in 0.1°C steps (51 to 113°F in 1°F steps), OFF (default setting: OR/ICU-38.0°C (100°F), NICU-39.0°C (102°F))
Tb lower limit:	OFF, 15.0 to 44.9°C in 0.1°C steps (50 to 112°F in 1°F steps) (default setting: OFF)

1. Display the ALARMS page of the CO window.
   Press [Menu] key → CO key → ALARMS tab.

2. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.


Selected parameter
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
ALARMS
Tb
38.0
OFF
Tb
[°C]
35.5
45.0
30.0
15.0
0.0
38.0
OFF
Current measured value
Upper limit
Upper limit slider
Lower limit
Lower limit slider
Setting bar
Current measured value

3. Press the [Home] key to return to the home screen.

Measuring the Pulmonary Capillary Wedge Pressure

Inserting and Retaining the Catheter in the Patient

For details and precautions on the methods of inserting the catheter, refer to relevant literature and manuals.

Inserting Position and Inserting Method

- Inserting position
  Elbow veins, basilic veins, external jugular veins, subclavian veins, femoral veins, and saphenous veins.
  Generally the upper limb arteries are used.

- Inserting method
  Arterial incision and Seldinger method.

Inserting the Catheter into the Patient and Monitoring Blood Pressure

WARNING

- Insert or remove the catheter from the pulmonary artery as quickly as possible. If it takes longer than about 10 seconds, pulmonary infarction, pulmonary hemorrhage or pulmonary artery perforation may occur.
- When inserting or removing the catheter, check the blood pressure waveform on the monitor, X-ray unit images, and other equipment. Do not depend on the insertion or removal messages displayed on the monitor.

NOTE

- Set the label to PAP to monitor the blood pressure for checking the catheter position.
- When inserting the catheter into the patient, monitor the blood pressure waveform and check the position of the catheter at all times.
- If inserting the catheter takes a long time, the catheter may soften from body heat or there may be spasm in the vein which makes inserting the catheter more difficult.
- Be careful not to burst the balloon. It may cause embolization. To inflate the balloon, use carbon dioxide and not air. Inflate the balloon slowly while observing the blood pressure waveform on the monitor.
- Arrhythmia may occur when the catheter is inserted through cardiac ventricle. Monitor ECG.

1. Insert the catheter to the right atrium quickly and inflate the balloon.

2. While checking the position of the catheter from the pressure waveform on the screen, push it slowly to the pulmonary artery in the direction of the blood flow.

3. After inserting the catheter to the position where the pulmonary capillary wedge pressure (PCWP) waveform can be obtained, deflate the balloon promptly, and check that the pulmonary artery pressure (PAP) waveform is obtained.

4. After determining the position at which the PCWP waveform is obtained when the balloon is inflated and the PAP waveform is obtained when deflated, retain the catheter in the pulmonary artery.

NOTE

Monitor the pulmonary artery pressure (PAP) waveform while retaining the catheter and check at all times that the tip of the catheter is at the main branches of the pulmonary artery and not wedging into a peripheral artery.

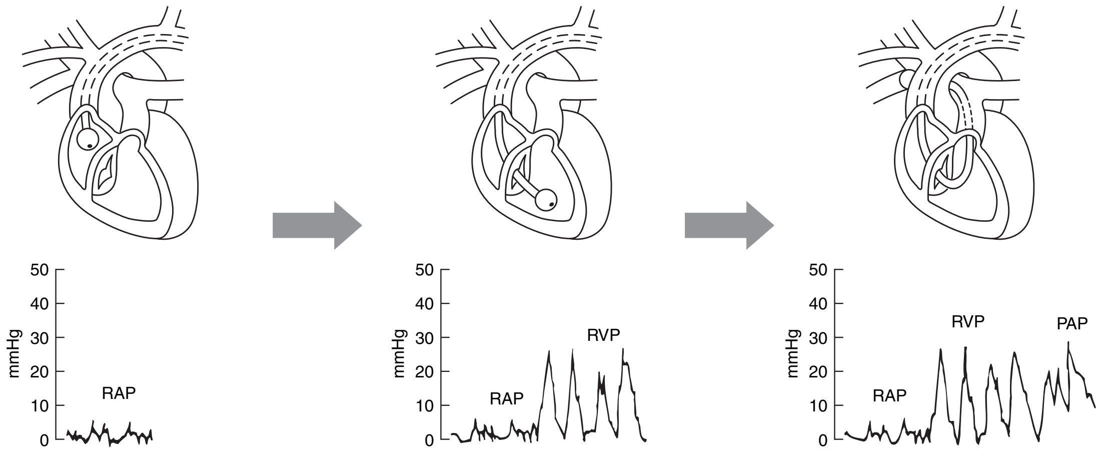
Measure the PCWP before CO measurement. Refer to the "Entering the Pulmonary Capillary Wedge Pressure and Other IBP Values" section.

Changes in Blood Pressure Waveform When Inserting Catheter (Example)

Right atrial pressure (RAP)

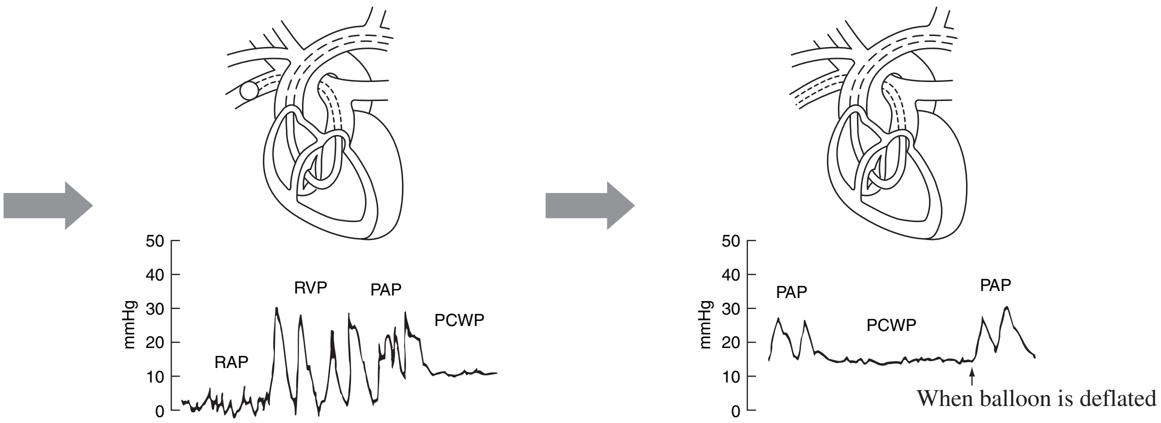
Right ventricular pressure (RVP)

Pulmonary artery pressure (PAP)



Pulmonary capillary wedge pressure (PCWP)

Pulmonary artery pressure (PAP)

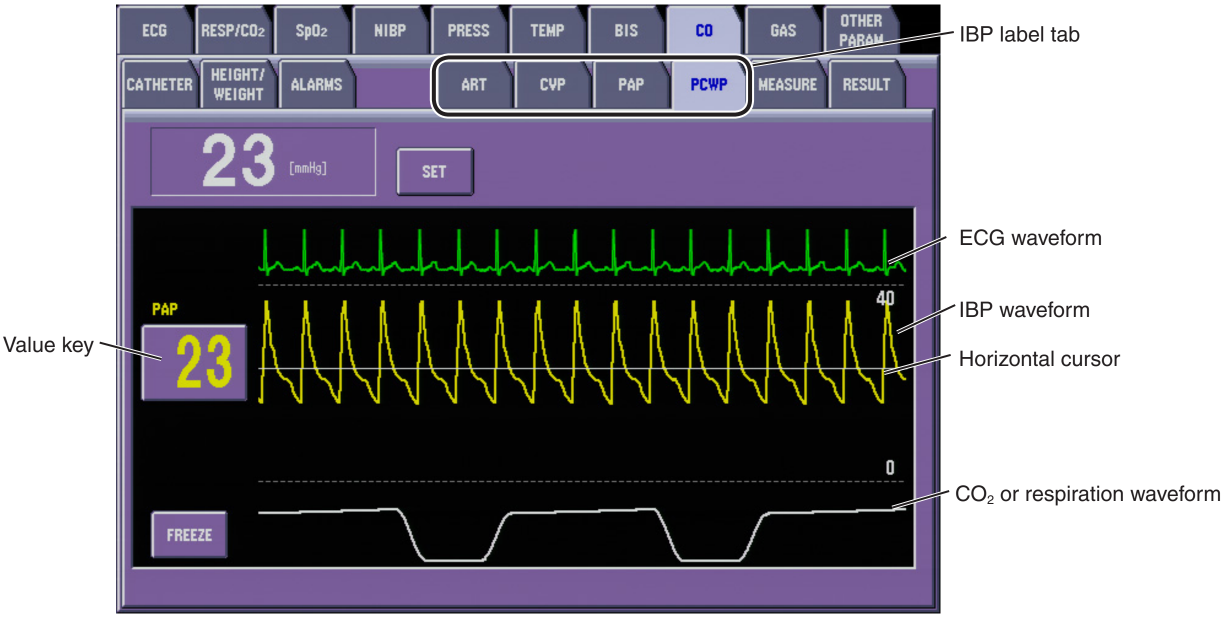


Entering the Pulmonary Capillary Wedge Pressure and Other IBP Values

Enter the PCWP and IBP values required for calculating CO. When the IBP lines are labeled correctly, these values are automatically entered.

1. Display the IBP page of the CO window.
   Press [Menu] key → CO key → IBP label tab.

   The value at the horizontal cursor appears in the value key beside the IBP waveform.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
23 [mmHg]
SET
PAP
23
40
0
FREEZE
IBP label tab
ECG waveform
IBP waveform
Horizontal cursor
Value key
CO2 or respiration waveform

   If necessary, you can change the value by moving the horizontal cursor with your finger. You can also freeze the waveform by touching the FREEZE key. To unfreeze, touch the FREEZE key again.

2. Touch the SET key to enter the value in the table on the RESULT page.

NOTE

To register the PCWP and IBP values to the hemodynamics list, refer to the “Registering Acquired Data to the Hemodynamics Table on the TREND Window” section.

Measuring CO

Before Measurement

Do the following before measurement.

1. Completely fill the blood pressure transducer, dome and tubes with physiological saline with heparin to eliminate air completely.

2. Inject physiological saline with heparin in the CVP lumen of the catheter using a syringe and check that liquid flows out from the tip of the CVP lumen.

3. Fill the PA lumen with physiological saline with heparin.

Check the following before measurement.

1. Check the injectate temperature (Ti) on the home screen or the CO window.

NOTE

When the injectate temperature is not appropriate, the “OUT OF RANGE” message appears on the screen and CO cannot be measured.

2. Check that the injectate temperature measurement lines (thermistor probe and inline sensor) are connected correctly.

NOTE

If these are disconnected, the monitor assumes the injectate temperature to be 0°C (32°F).

3. Check the catheter settings on the CATHETER page of the CO window.

NOTE

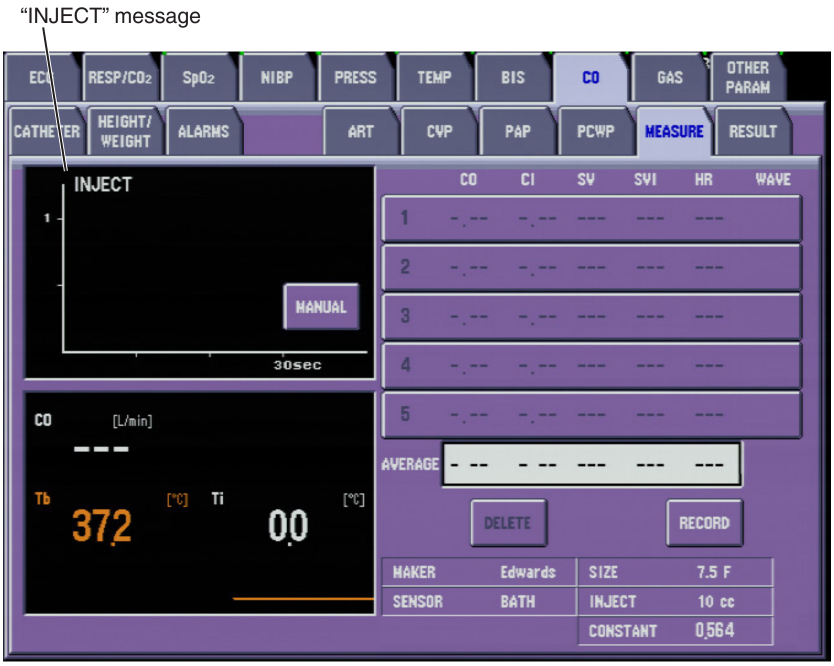
The settings, such as injectate volume and catheter size are necessary for calculating CO. These settings cannot be changed after measurement.

Measuring CO

CAUTION

Do not measure the cardiac output repeatedly at short intervals. Frequently injecting the injectate affects the measuring accuracy.

1. Display the MEASURE page of the CO window.
   Press [Menu] key → CO key → MEASURE tab.


"INJECT" message
ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
INJECT
1
MANUAL
30sec
DELETE
RECORD

CO [L/min] ---

Tb [°C] 37.2 Ti [°C] 0.0

	CO	CI	SV	SVI	HR	WAVE
1	-.--	-.--	---	---	---	
2	-.--	-.--	---	---	---	
3	-.--	-.--	---	---	---	
4	-.--	-.--	---	---	---	
5	-.--	-.--	---	---	---	
AVERAGE	-.--	-.--	---	---	---	

MAKER	Edwards	SIZE	7.5 F
SENSOR	BATH	INJECT	10 cc
		CONSTANT	0.564

2. Check that the "INJECT" message is displayed on the CO window and inject the injectate quickly within 4 minutes. CO measurement starts.

NOTE

- If the injectate is not injected within 4 minutes, the "INJECTION TIME OUT" message appears. In this case, touch the MANUAL key on the MEASURE window and inject the injectate within 30 seconds.
- Inject the injectate as quickly and steadily as possible. Measurement cannot be performed correctly if injected slowly.

3. Check that the "MEASURING CO" message is displayed on the CO window.

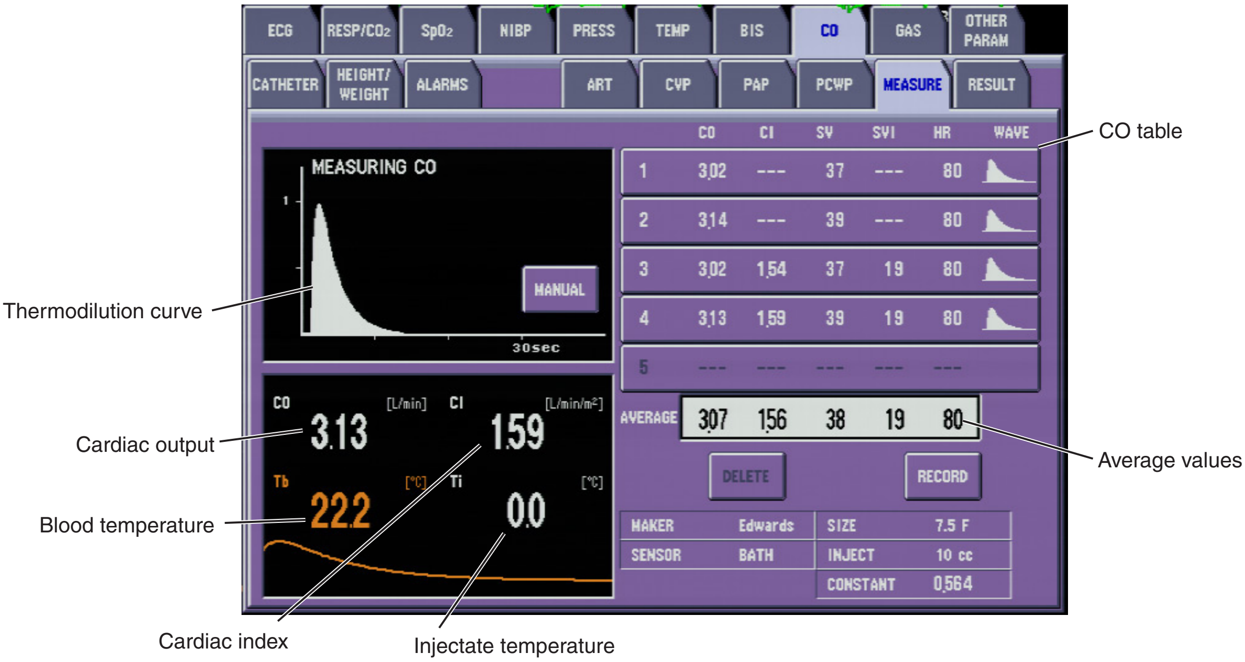
NOTE

The monitor has not acknowledged the injection if the "MEASURING CO" message is not displayed on the CO window within about 10 seconds after the injectate has been injected. If this happens, inject the injectate again.

When the CO value is calculated, the measurement results are displayed in the CO table on the CO window.

NOTE

Do not close the CO window before the measurement result is displayed in the CO table. Otherwise, the measured data will be lost.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
MEASURING CO
1
MANUAL
30sec
DELETE
RECORD
CO table
Thermodilution curve
Cardiac output
Blood temperature
Cardiac index
Injectate temperature
Average values

	CO	CI	SV	SVI	HR	WAVE
1	3.02	---	37	---	80	
2	3.14	---	39	---	80	
3	3.02	1.54	37	19	80	
4	3.13	1.59	39	19	80	
5	---	---	---	---	---	
AVERAGE	3.07	1.56	38	19	80	

CO [L/min] 3.13
CI [L/min/m²] 1.59
Tb [°C] 22.2
Ti [°C] 0.0

MAKER	Edwards	SIZE	7.5 F
SENSOR	BATH	INJECT	10 cc
		CONSTANT	0.564

When the “INJECT” message is displayed on the MEASURE window again, the injectate can be injected again.

Up to five measurement data can be stored in memory and displayed in the CO table. If more than five measurements are performed, the oldest data is deleted.

Current average CO and PCWP values and the measured time are displayed on the home screen. The data dims after 15 minutes and disappears from the home screen after 24 hours. When data is added to the hemodynamics trend table in the HEMO page of the TREND window, the data disappears from the home screen.

NOTE

To register the CO data to the hemodynamics trend table, refer to the “Registering Acquired Data to the Hemodynamics Table on the TREND Window” section.

When Measurements Cannot be Performed Correctly

In some cases, measurements cannot be performed correctly because the baseline moves due to noise or conditions of the patient, such as physiological changes. In such cases, touch the MANUAL key on the MEASURE window and inject the injectate within 30 seconds. The point when the MANUAL key is pressed is the start of measurement.

NOTE

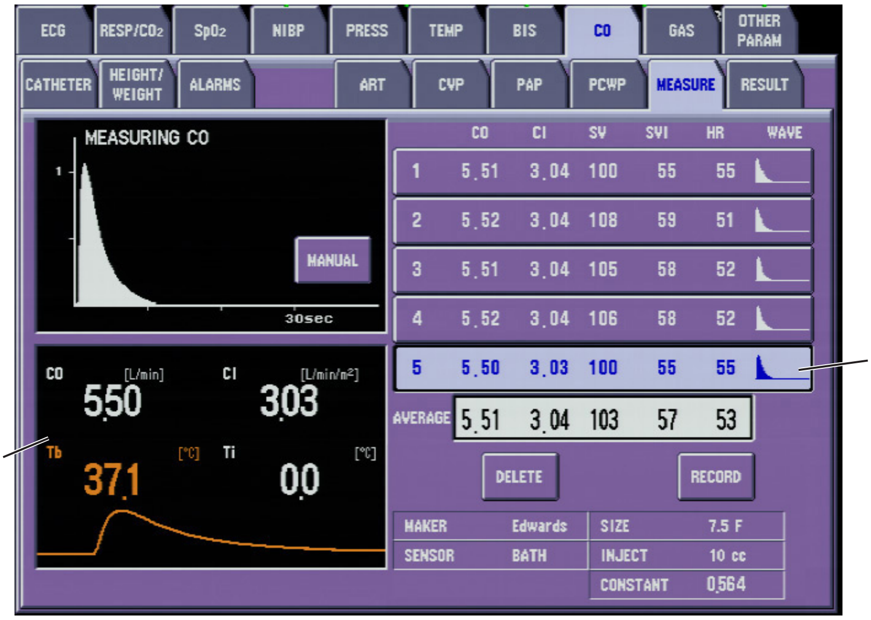
If the injectate is not injected within 30 seconds, the “INJECTION TIME OUT” message appears.

Deleting the Data from the CO Table

Up to five measurement data can be stored and displayed in the CO table on the CO window. Stored data can be deleted from the list.

1. Display the MEASURE page of the CO window.
   Press [Menu] key → CO key → MEASURE tab.

2. Select the data to be deleted from the CO table. The thermodilution curve and measured values of the selected data appear on the left part of the CO window.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
MEASURING CO
1
MANUAL
30sec
DELETE
RECORD

CO [L/min] 5.50 CI [L/min/m²] 3.03
Tb [°C] 37.1 Ti [°C] 0.0

	CO	CI	SV	SVI	HR	WAVE
1	5.51	3.04	100	55	55	
2	5.52	3.04	108	59	51	
3	5.51	3.04	105	58	52	
4	5.52	3.04	106	58	52	
5	5.50	3.03	100	55	55	
AVERAGE	5.51	3.04	103	57	53	

MAKER	Edwards	SIZE	7.5 F
SENSOR	BATH	INJECT	10 cc
		CONSTANT	0.564

Values of the selected data

Selected data

3. Touch the DELETE key to delete data. The average is calculated again.

Recording Hemodynamics Data

Up to 5 hemodynamics data and thermodilution curves on the CO window can be recorded on the optional recorder.

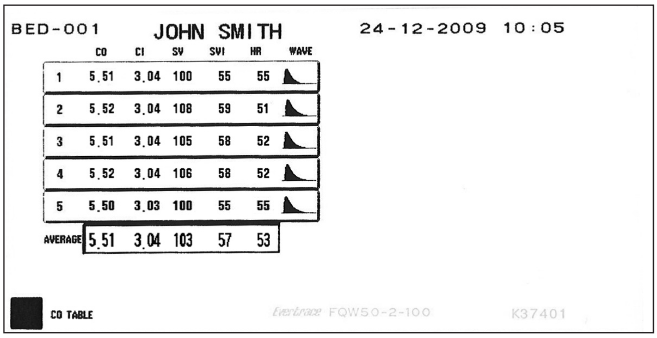
1. Display the MEASURE page of the CO window.
   Press [Menu] key → CO key → MEASURE tab.

2. Touch the RECORD key on the MEASURE window.

   To stop recording, press the [Record] key.

3. Press the [Home] key to return to the home screen.

Recording example



BED-001 JOHN SMITH 24-12-2009 10:05

	CO	CI	SV	SVI	HR	WAVE
1	5.51	3.04	100	55	55	
2	5.52	3.04	108	59	51	
3	5.51	3.04	105	58	52	
4	5.52	3.04	106	58	52	
5	5.50	3.03	100	55	55	
AVERAGE	5.51	3.04	103	57	53	

CO TABLE

Evertrace FQW50-2-100 K37401

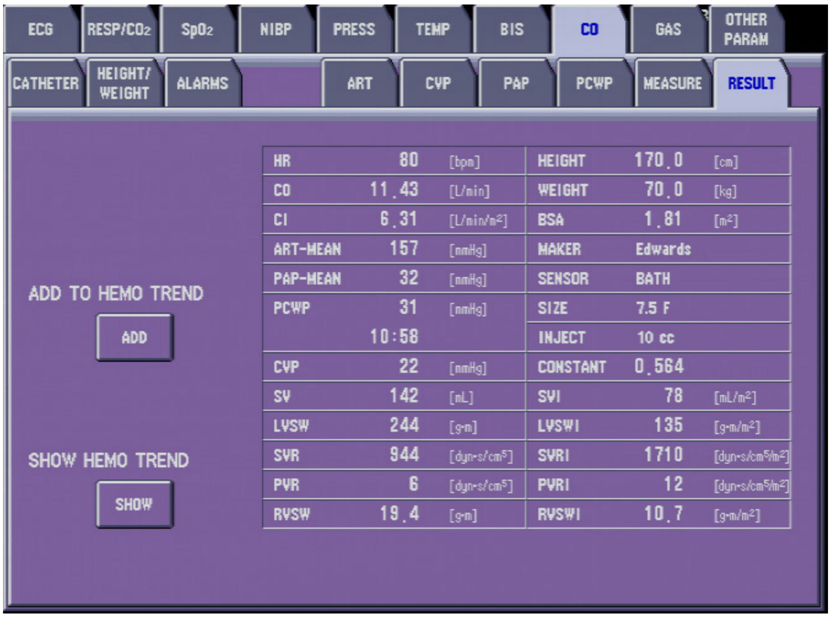
Registering Acquired Data to the Hemodynamics Table on the TREND Window

The acquired CO data can be added to the hemodynamics table on the HEMO page of the TREND window. When data is added to the HEMO page, the data disappears from the home screen and CO window. “- - -” appears on the CO data display area on the screen.

1. Display the RESULT page of the CO window. Press [Menu] key → CO key → RESULT tab.

2. Touch the ADD key under the ADD TO HEMO TREND. The data on the RESULT window is registered on the HEMO page.

3. Touch the SHOW key under the SHOW HEMO TREND to display the HEMO page. The registered CO data is displayed on the HEMO page. For details, refer to User’s Guide Part I, Section 6.



ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
CATHETER
HEIGHT/ WEIGHT
ALARMS
ART
CVP
PAP
PCWP
MEASURE
RESULT
ADD TO HEMO TREND
ADD
SHOW HEMO TREND
SHOW

HR	80	[bpm]	HEIGHT	170.0	[cm]
CO	11.43	[L/min]	WEIGHT	70.0	[kg]
CI	6.31	[L/min/m²]	BSA	1.81	[m²]
ART-MEAN	157	[mmHg]	MAKER	Edwards	
PAP-MEAN	32	[mmHg]	SENSOR	BATH	
PCWP	31	[mmHg]	SIZE	7.5 F	
	10:58		INJECT	10 cc	
CVP	22	[mmHg]	CONSTANT	0.564	
SV	142	[mL]	SVI	78	[mL/m²]
LVSW	244	[g·m]	LVSWI	135	[g·m/m²]
SVR	944	[dyn·s/cm⁵]	SVRI	1710	[dyn·s/cm⁵/m²]
PVR	6	[dyn·s/cm⁵]	PVRI	12	[dyn·s/cm⁵/m²]
RVSW	19.4	[g·m]	RVSWI	10.7	[g·m/m²]

Explanation of Hemodynamics Data

Label	Name	Unit	Explanation and Equation
HR	Heart rate	bpm	Heart rate at the time the CO is measured.
CO	Cardiac output	L/min	—
CI	Cardiac index	L/min/m^2	CI = CO/BSA*[1]
CCO	Continuous cardiac output	L/min	—
CCI	Continuous cardiac output index	L/min/m^2	CCI = CCO/BSA*[1]
ART-MEAN	Arterial mean pressure	mmHg	Values registered at the time the CO is measured.
PAP MEAN	Pulmonary arterial mean pressure		
PCWP	Pulmonary capillary wedge pressure		
PCWP TIME	Time PCWP is measured	hr:min	
CVP	Central venous mean pressure	mmHg	
SV	Stroke volume	mL	SV = (CO × 1000)/HR
SVI	Stroke volume index	mL/m^2	SVI = (CI × 1000)/HR
SVR	Systemic vascular resistance	dyn•s/cm^5	SVR = {(AP M − CVP M) × 80}/CO
SVRI	Systemic vascular resistance index	dyn•s•m^2/cm^5*[2]	SVRI = {(AP M − CVP M) × 80}/CI
PVR	Pulmonary vascular resistance	dyn•s/cm^5	PVR = {(PAP M − PCWP) × 80}/CO
PVRI	Pulmonary vascular resistance index	dyn•s•m^2/cm^5*[2]	PVRI = {(PAP M − PCWP) × 80}/CI
LVSW	Left ventricular stroke work	g•m	LVSW = {SV × (AP M − PCWP)} × 0.0136
LVSWI	Left ventricular stroke work index	g•m/m^2	LVSWI = {SVI × (AP M − PCWP)} × 0.0136
RVSW	Right ventricular stroke work	g•m	RVSW = {SV × (PAP M − CVP M)} × 0.0136
RVSWI	Right ventricular stroke work index	g•m/m^2	RVSWI = {SVI × (PAP M − CVP M)} × 0.0136
EDV	End diastolic volume	mL	—
EDVI	End diastolic volume index	mL/m^2	EDVI = EDV/BSA*
ESV	End systolic volume	mL	—
ESVI	End systolic volume index	mL/m^2	ESVI = ESV/BSA*
EF	Ejection fraction	%	—

*[1] BSA = 0.007184 × Weight$^{0.425}$ × Height$^{0.725}$ (m^2) (DuBois equation)

*[2] When the blood pressure unit is kPa, this unit becomes kPa•s•m^2/L.

CO Value Calculation Equation/Coefficient Value Calculation Value

In this monitor, the CO value is calculated using the following equation.

$$\boxed{\mathrm{CO} = \frac{(1.08)\mathrm{Ct}(60)\mathrm{V}(\mathrm{Tb}-\mathrm{Ti})}{1000\int_0^{\infty}\Delta \mathrm{Tbdt}}}$$

$$1.08 = \frac{\rho\mathrm{Cp}\text{ in the injectate}}{\rho\mathrm{Cp}\text{ in the blood}}$$

ρ : density

Cp: specific heat

Ct = Compensated coefficient (determined by the catheter manufacturer, size, V and Ti)

60 = seconds in a minute

V = Injectate volume (mL)

Tb = Blood temperature (℃)

Ti = Injectate temperature (℃)

$\int_0^{\infty}\Delta$ Tbdt = Integrated value of the thermodilution curve

$$\boxed{\frac{(1.08)\mathrm{Ct}(60)\mathrm{V}}{1000} = \text{Coefficient value}}$$

Section 10 Gas Monitoring

General.......... 10.2
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Preparing for Gas Monitoring.......... 10.4
    Preparation Flowchart for Using the Multigas Unit.......... 10.4
    Preparation Flowchart for Using the Dräger Medical Primus/Fabius® Anesthesia Workstation.......... 10.4
Monitoring Gas.......... 10.5
    Gas Information on the Home Screen.......... 10.6
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Changing Gas Settings.......... 10.9
    Changing the Respiration Rate, Apnea and Gas Alarm Limits.......... 10.10
    Changing the Waveform Scale.......... 10.12
    Changing the Sampling Rate.......... 10.13
    Performing Zero Calibration.......... 10.14
    Turning Gas Measurement On or Off.......... 10.15
    Selecting the Parameters to be Displayed on the Home Screen.......... 10.16
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General

The concentration of gases administered to and respired by the patient during anesthesia can be monitored by connecting the AG-920R multigas unit, GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit to the multi-link socket on the monitor. To connect the AG-920R multigas unit to the monitor, the QF-904P interface is required.

NOTE

GF-210R multigas unit and GF-120PA or GF-220R multigas/flow unit are not available for BSM-6000A series.

Carbon dioxide (CO_2), nitrous oxide (N_2O), oxygen (O_2), and any of five anesthetic agents (Halothane, Isoflurane, Enflurane, Sevoflurane and Desflurane) are monitored on a real-time, breath-by-breath basis. The inspiration and expiration phases are detected from the instantaneous CO_2 concentration and the respiration rate is counted from these phases. The measured data are displayed on the home screen and can be viewed with reference to other vital sign data.

The gas monitoring is also available by connecting a Dräger Medical Primus/Fabius® anesthesia workstation to the bedside monitor with IF-920P communication cable. Fabius is a registered trademark of Dräger Medical AG & Co. KG.

NOTE

- When using the Dräger Medical Primus/Fabius® anesthesia workstation and the bedside monitor is connected to a central monitor network, gas values and waveforms are not output to the central monitor from the bedside monitor. No data or alarm regarding the gas data from the anesthesia workstation are displayed on the central monitor. Be careful on gas monitoring when the bedside monitor is connected to a central monitor network.
- The IF-920P communication cable is not available for BSM-6000A series.
- A Dräger Medical Primus/Fabius® anesthesia workstation cannot be used with any of the following external instruments.
  - AG-920R multigas unit
  - GF-110PA/GF-210R multigas unit
  - GF-120PA/GF-220R multigas/flow unit
  - Ventilator

Measuring Parameters

The parameters that can be displayed on the monitor screen depend on the unit or instrument type as shown below.

Yes: displayed No: not displayed

Terms		Meaning	Unit	Measurement Method	Unit/Instrument Type		
					Nihon Kohden Multigas Unit	Dräger Medical Primus	Dräger Medical Fabius®
RR		Respiration rate	Counts/min	—	Yes	No	No
O_2		Oxygen	%	Paramagnetic	Yes	Yes	Yes
CO_2		Carbon dioxide	mmHg	Non-dispersive infrared ray absorption	Yes	Yes	Yes
N_2O		Nitrous oxide	%	Non-dispersive infrared ray absorption	Yes	Yes	Yes
Agent	HAL	Halothane	%	Non-dispersive infrared ray absorption	Yes	Yes	No
	ISO	Isoflurane					
	ENF	Enflurane					
	SEV	Sevoflurane					
	DES	Desflurane					
MAC*		Minimum alveolar concentration	—	Calculated from the monitored gas	Yes	Yes	No

* You can select from three methods for calculating MAC: non-corrective MAC, ambient pressure corrected MAC and enhanced MAC correction. The ambient pressure corrected MAC and enhanced MAC correction methods are only available with a GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit. For details about the calculation method, refer to the multigas unit or multigas/flow unit operator’s manual.

The ambient pressure corrected MAC and enhanced MAC correction methods are not available for BSM-6000A series.

Preparing for Gas Monitoring

Preparation Flowchart for Using the Multigas Unit

1. Set up the multigas unit and connect the unit to the patient. Refer to the operator's manual of the AG-920R multigas unit, GF-110PA or GF210R multigas unit or GF-220R or GF-120PA multigas/flow unit.

2. Perform calibration.

3. Select the sampling rate and change necessary settings when using an AG-920R or GF-110PA multigas unit or GF-120PA multigas/flow unit.

4. Start monitoring.

Preparation Flowchart for Using the Dräger Medical Primus/Fabius® Anesthesia Workstation

1. Set up the anesthesia workstation and connect it to the bedside monitor. Refer to the IF-920P communication cable manual.

2. Connect the anesthesia workstation to the patient. Refer to the anesthesia workstation manual.

3. Start monitoring and change necessary settings.

Monitoring Gas

After completing the preparation, gas data and waveforms appear on the screen.

Using AG-920R or GF-110PA Multigas Unit or GF-120PA Multigas/Flow Unit

NOTE

- The gas monitoring starts about 45 seconds after the [MEASURE] lamp on the multigas unit lights. The measurement accuracy is guaranteed for about 10 minutes after the [MEASURE] lamp lights.
- Inspired and expired values are not accurate soon after starting monitoring. These values stabilize after the respiration rate appears on the screen.

Auto Calibration

The monitor periodically performs the zero calibration with air at the following intervals. Manually perform the zero calibration when inappropriate measurement data appears and before performing gas calibration. It takes about 5 seconds for the zero calibration to complete. Refer to the “Performing Zero Calibration” section.

Using GF-210R Multigas Unit or GF-220R Multigas/Flow Unit

NOTE

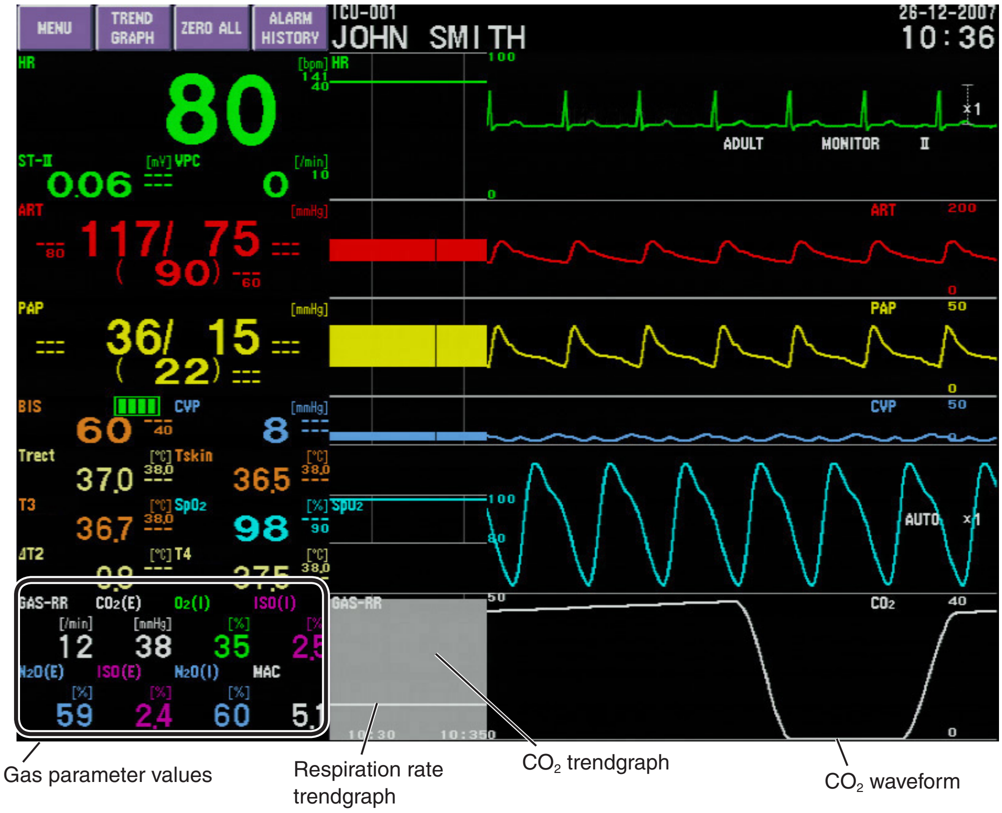
- The gas monitoring starts about 1 minute after the [MEASURE] lamp on the multigas unit lights. The measurement accuracy is guaranteed for about 6 minutes after the [MEASURE] lamp lights.
- Inspired and expired values are not accurate soon after starting monitoring. These values stabilize after the respiration rate appears on the screen.

Auto Calibration

The monitor performs the zero calibration with air every 2 hours when the multigas unit is in the steady state. Manually perform the zero calibration when inappropriate measurement data appears. It takes about 1 minute for the zero calibration to complete. Refer to the “Performing Zero Calibration” section.

Gas Information on the Home Screen

Using Multigas Unit

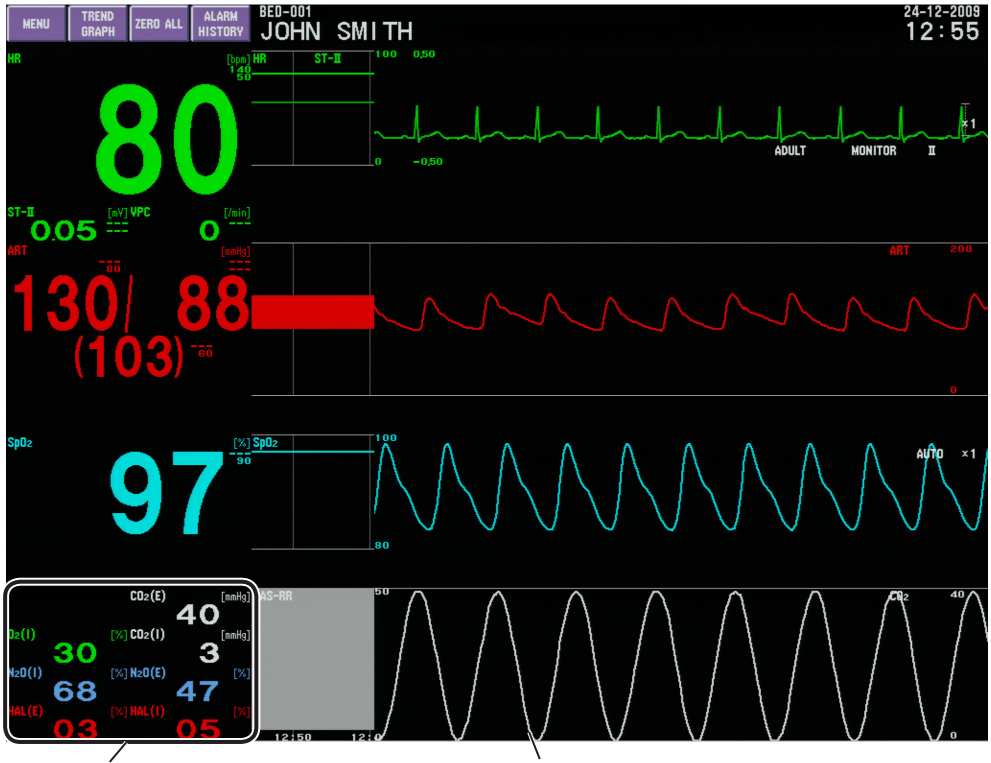

MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
26-12-2007
10:36
HR
80
ST-II
0.06
VPC
0
ART
117/ 75
(90)
PAP
36/ 15
(22)
BIS
60
CVP
8
Trect
37.0
Tskin
36.5
T3
36.7
SpO2
98
dT2
T4
ADULT
MONITOR
II
AUTO
GAS-RR
CO2(E)
O2(I)
ISO(I)
12
38
35
N2O(E)
ISO(E)
N2O(I)
MAC
59
2.4
60
CO2
Gas parameter values
Respiration rate trendgraph
CO_2 trendgraph
CO_2 waveform

Up to 8 gas parameters selected on the OTHER page of the GAS window are displayed on the home screen. To change the displaying parameters, refer to the “Selecting Parameters to be Displayed on the Home Screen” section.

The type of MAC on the home screen depends on the MAC setting on the GAS page of the PARAMETERS window in the SYSTEM SETUP window. Refer to Section 3, Administrator’s Guide.

Using Dräger Medical Primus/Fabius® Anesthesia Workstation

> **WARNING**
>
> When using the Drager Medical Primus/Fabius® anesthesia workstation, some anesthesia workstation alarms do not function on the bedside monitor. When the gas data on the bedside monitor is abnormal or the anesthesia workstation is giving an alarm, check the messages and data on the anesthesia workstation.

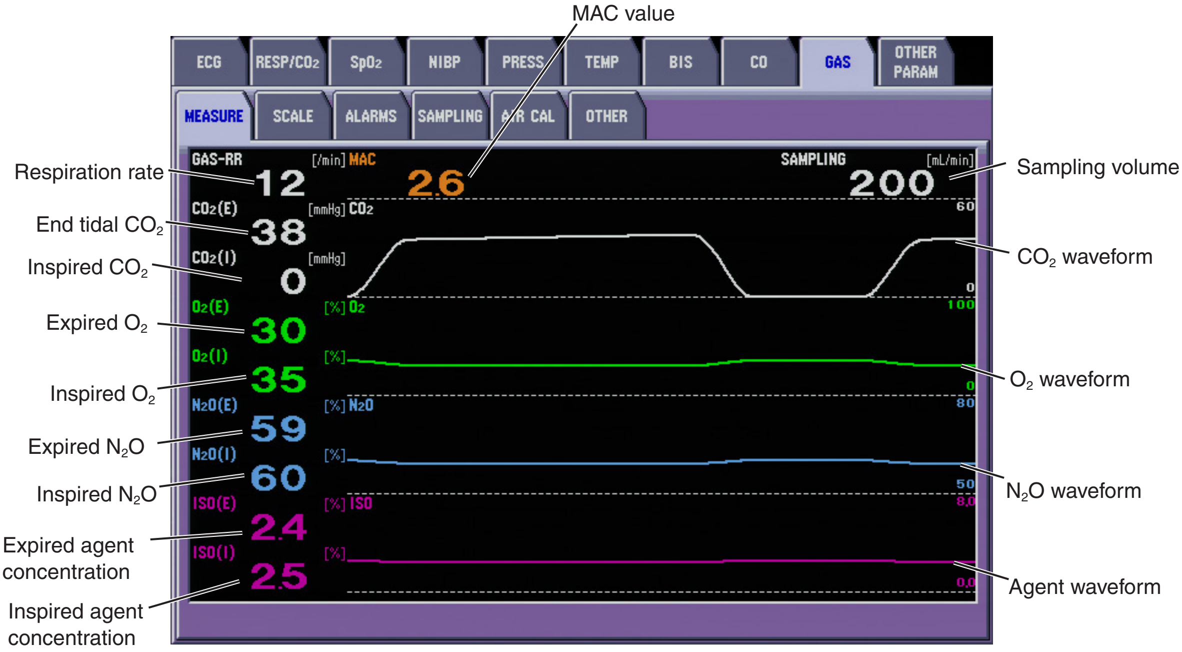

MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
24-12-2009
12:55
HR
80
ST-II
0.05
VPC
0
ADULT
MONITOR
II
ART
130/ 88
(103)
SpO2
97
AUTO
×1
CO2(E) [mmHg]
40
O2(I)
30
CO2(I) [mmHg]
3
N2O(I)
68
N2O(E) [%]
47
HAL(E)
03
HAL(I) [%]
05
CO2

Gas parameter values

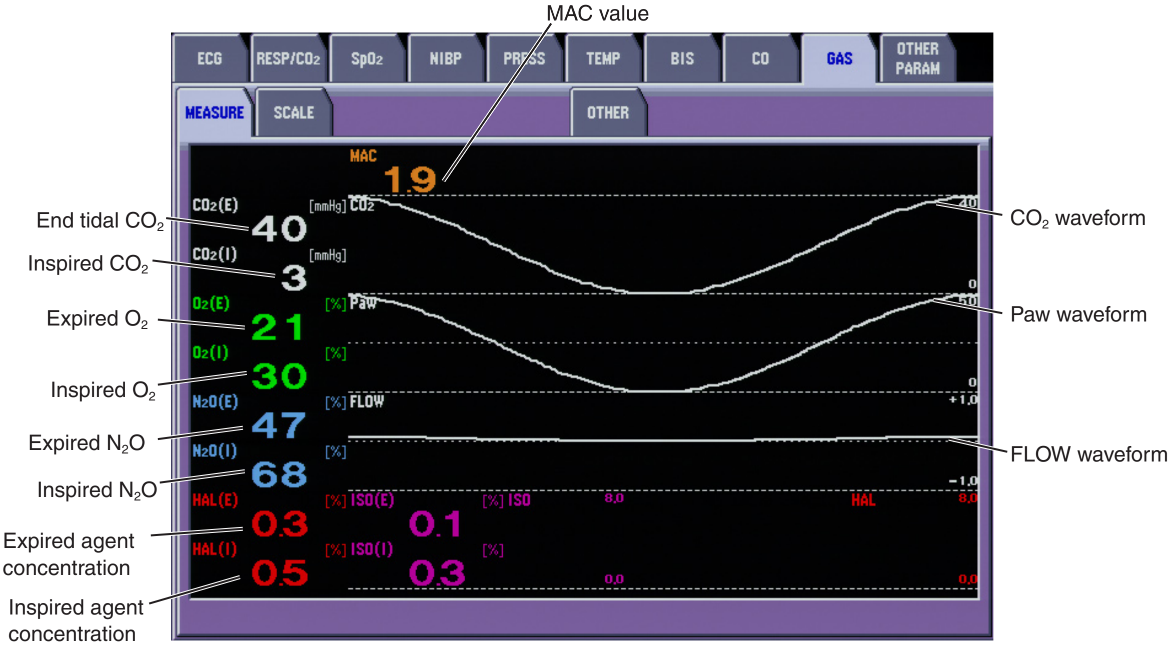
CO_2 waveform

Gas Information on the GAS Window

Using Multigas Unit


MAC value
ECG RESP/CO2 SpO2 NIBP PRESS TEMP BIS CO GAS OTHER PARAM
MEASURE SCALE ALARMS SAMPLING AIR CAL OTHER
GAS-RR [/min] 12
MAC 2.6
SAMPLING [mL/min] 200
CO2(E) [mmHg] 38
CO2(I) [mmHg] 0
O2(E) [%] 30
O2(I) [%] 35
N2O(E) [%] 59
N2O(I) [%] 60
ISO(E) [%] 2.4
ISO(I) [%] 2.5
Respiration rate
End tidal CO_2
Inspired CO_2
Expired O_2
Inspired O_2
Expired N_2O
Inspired N_2O
Expired agent concentration
Inspired agent concentration
Sampling volume
CO_2 waveform
O_2 waveform
N_2O waveform
Agent waveform

Using Dräger Medical Primus/Fabius® Anesthesia Workstation


MAC value
ECG RESP/CO2 SpO2 NIBP PRESS TEMP BIS CO GAS OTHER PARAM
MEASURE SCALE OTHER
MAC 1.9
CO2(E) [mmHg] 40
CO2(I) [mmHg] 3
O2(E) [%] 21
O2(I) [%] 30
N2O(E) [%] 47
N2O(I) [%] 68
HAL(E) [%] 0.3
HAL(I) [%] 0.5
ISO(E) [%] 0.1
ISO(I) [%] 0.3
End tidal CO_2
Inspired CO_2
Expired O_2
Inspired O_2
Expired N_2O
Inspired N_2O
Expired agent concentration
Inspired agent concentration
CO_2 waveform
Paw waveform
FLOW waveform

Changing Gas Settings

Change the settings on the GAS window. The following settings can be changed for gas monitoring.

Using Multigas Unit

- Respiration rate, apnea, CO_2, O_2, N_2O and agent alarm settings
- Scale for CO_2, O_2, N_2O and agent waveforms
- Sampling rate (when using AG-920R or GF-110PA multigas unit or GF-120PA multigas/flow unit)
- Perform zero calibration
- Displaying gas parameters on the home screen
- Gas measurement on or off (when using GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit)

Using Dräger Medical Primus/Fabius® Anesthesia Workstation

Scale for CO_2, FLOW and Paw waveforms

The CO_2 unit can be set to mmHg or kPa on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.

The following settings can be set on the PARAMETERS window of the SYSTEM SETUP window when using GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit. Refer to Section 3 of the Administrator's Guide.

- Set the time to delete anesthetic agent data from the home screen after the end of gas monitoring.
- Set the time to display spontaneous value instead of Fi/ET values for gas values when there is apnea.
- Select the temperature and humidity for compensating the CO_2 measurement values.
- Select the type of MAC to be displayed.
- Select whether or not to compensate the sampled gas rate when monitoring FLOW/Paw.

The display color for each gas can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Changing the Respiration Rate, Apnea and Gas Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

This setting is not available when using a Dräger Medical Primus/Fabius® anesthesia workstation.

You can set the upper and lower CO_2, O_2, N_2O, anesthetic agent, respiration rate and apnea alarm limits on the GAS window. You can set all alarms, including the upper and lower CO_2, O_2, N_2O, anesthetic agent, respiration rate and apnea alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I). You can also set upper and lower respiration rate and apnea alarm limits on the RESP, CO_2 and FLOW/Paw windows. (FLOW/Paw window is not available for BSM-6000A series.) You can also set upper and lower CO_2 alarm limits on the CO_2 window. You can also set upper and lower O_2 alarm limits on the O_2 window.

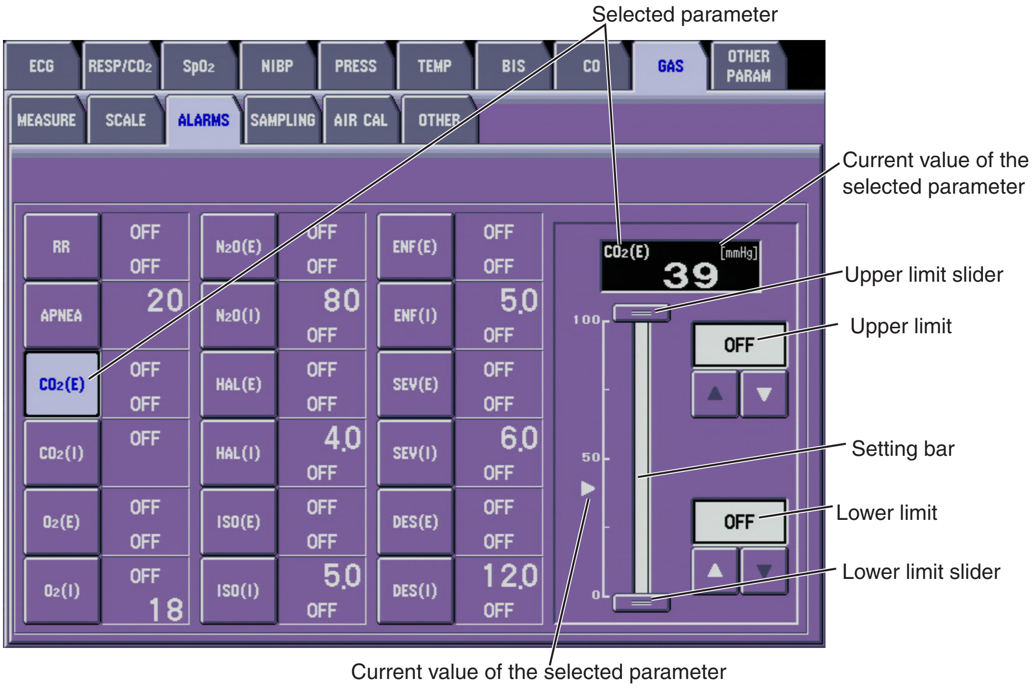
Setting Range

$ETCO_2$ upper limit:	2 to 99 mmHg in 1 mmHg steps (1.0 to 13.5 kPa in 0.5 kPa steps), OFF (default setting: OFF)
$ETCO_2$ lower limit:	OFF, 1 to 98 mmHg in 1 mmHg steps (0.5 to 13.0 kPa in 0.5 kPa steps) (default setting: OFF)
CO_2 (I) upper limit:	1 to 5 mmHg in 1 mmHg steps (0.1 to 0.7 kPa in 0.1 kPa steps), OFF (default setting: OR-3 mmHg (0.4 kPa), ICU/NICU-OFF)
O_2 (E) upper limit:	11 to 100% in 1% steps, OFF (default setting: OFF)
O_2 (E) lower limit:	OFF, 10 to 99% in 1% steps (default setting: OFF)
O_2 (I) upper limit:	19 to 100% in 1% steps, OFF (default setting: OFF)
O_2 (I) lower limit:	18 to 99% in 1% steps (default setting: 18%)
N_2O (E), N_2O (I) upper limit:	1 to 100% in 1% steps, OFF (default setting: N_2O (E) OFF, N_2O (I) 80%)
N_2O (E), N_2O (I) lower limit:	OFF, 0 to 99% in 1% steps (default setting: OFF)
HAL (E), HAL (I) upper limit:	0.1 to 7.0% in 0.1% steps, Off (default setting: HAL (E) OFF, HAL (I) 4.0%)
HAL (E), HAL (I) lower limit:	OFF, 0.0 to 6.9% in 0.1% steps (default setting: OFF)
ISO (E), ISO (I) upper limit:	0.1 to 7.0% in 0.1% steps, OFF (default setting: ISO (E) OFF, ISO (I) 5.0%)
ISO (E), ISO (I) lower limit:	OFF, 0.0 to 6.9% in 0.1% steps (default setting: OFF)
ENF (E), ENF (I) upper limit:	0.1 to 7.0% in 0.1% steps, OFF (default setting: ENF (E) OFF, ENF (I) 5.0%)

ENF (E), ENF (I) lower limit:	OFF, 0.0 to 6.9% in 0.1% steps (default setting: OFF)
SEV (E), SEV (I) upper limit:	0.1 to 7.0% in 0.1% steps, OFF (default setting: SEV (E) OFF, SEV (I) 6.0%)
SEV (E), SEV (I) lower limit:	OFF, 0.0 to 6.9% in 0.1% steps (default setting: OFF)
DES (E), DES (I) upper limit:	0.1 to 20.0% in 0.1% steps, OFF (default setting: DES (E) OFF, DES (I) 12%)
DES (E), DES (I) lower limit:	OFF, 0.0 to 19.9% in 0.1% steps (default setting: OFF)
Respiration rate upper limit:	2 to 150 counts/min in 2 counts/min steps, OFF (default setting: OFF)
Respiration rate lower limit:	OFF, 0 to 148 counts/min in 2 counts/min steps (default setting: OFF)
Apnea upper limit:	5 to 40 s in 5 s steps, OFF (default setting: 20)

1. Display the ALARMS page of the GAS window.
   Press [Menu] key → GAS key → ALARMS tab.

2. Touch the parameter key to change the alarm setting.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
RR OFF OFF
APNEA 20
CO2(E) OFF OFF
CO2(I) OFF
O2(E) OFF OFF
O2(I) OFF 18
N2O(E) OFF OFF
N2O(I) 80 OFF
HAL(E) OFF OFF
HAL(I) 4.0 OFF
ISO(E) OFF OFF
ISO(I) 5.0 OFF
ENF(E) OFF OFF
ENF(I) 5.0 OFF
SEV(E) OFF OFF
SEV(I) 6.0 OFF
DES(E) OFF OFF
DES(I) 12.0 OFF
CO2(E) [mmHg] 39
100
50
0
OFF
OFF

Selected parameter

Current value of the selected parameter

Upper limit slider

Upper limit

Setting bar

Lower limit

Lower limit slider

Current value of the selected parameter

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.
   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.

4. Press the [Home] key to return to the home screen.

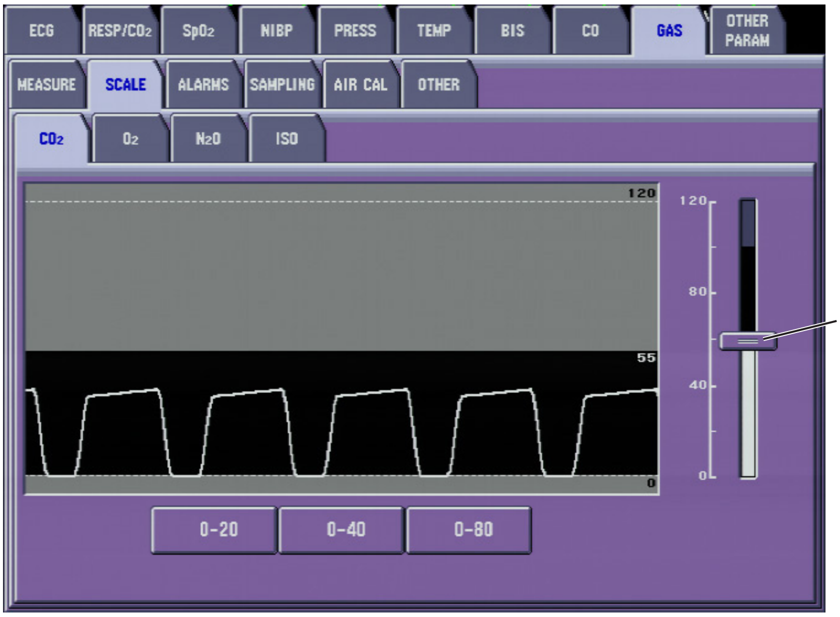
Changing the Waveform Scale

The scale can be changed for the CO_2, O_2, N_2O and agent waveforms when using a multigas unit or CO_2, FLOW and Paw waveforms when using a Dräger Medical Primus/Fabius® anesthesia workstation. The same scale is used on both the home screen and GAS window.

1. Display the SCALE page of the desired parameter on the GAS window. Press [Menu] key → GAS key → SCALE tab → parameter tab.

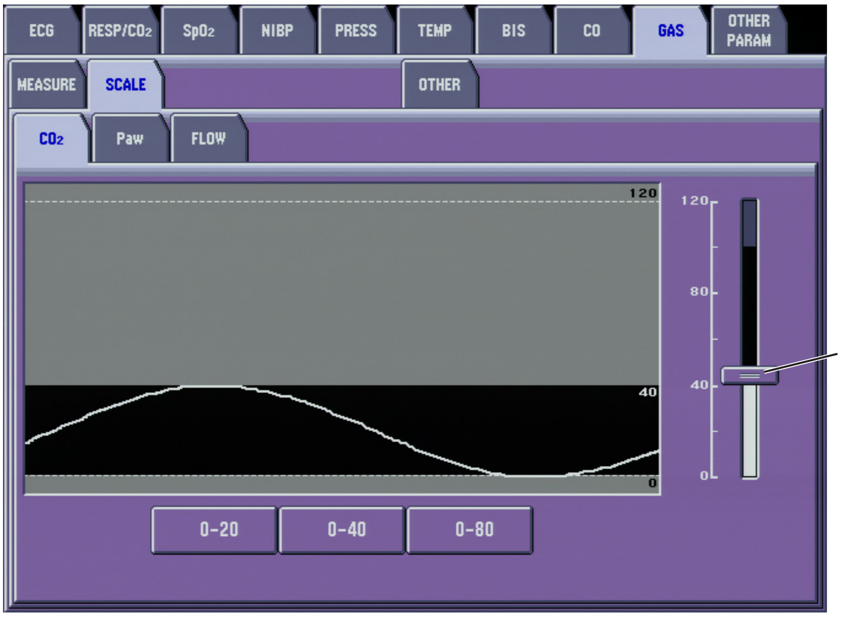
2. Select the appropriate scale for the parameter. You can adjust the scale using the scale slider.

Using Multigas Unit


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
CO2
O2
N2O
ISO
120
55
0
120
80
40
0
0-20
0-40
0-80

Scale slider

Using Dräger Medical Primus/Fabius® Anesthesia Workstation


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
OTHER
CO2
Paw
FLOW
120
40
0
120
80
40
0
0-20
0-40
0-80

Scale slider

3. Press the [Home] key to return to the home screen.

Changing the Sampling Rate

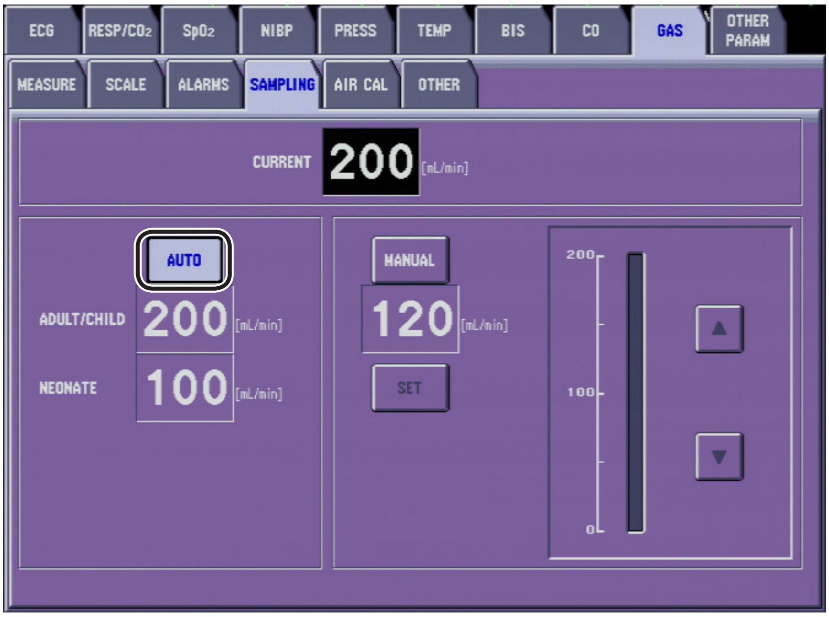
This setting is not available when using a GF-210R multigas unit, GF-220R multigas/flow unit or Dräger Medical Primus/Fabius® anesthesia workstation.

There is AUTO mode and MANUAL mode for the sampling rate. The default setting is AUTO.

AUTO mode:	Sampling rate is 200 mL/min when a water trap for adult is connected to the multigas unit. Sampling rate is 100 mL/min when a water trap for neonate is connected to the multigas unit.
MANUAL mode:	You can select from 120 to 200 mL/min in 5 mL/min steps when a water trap for adult is connected to the multigas unit. You can select from 70 to 120 mL/min in 5 mL/min steps when a water trap for neonate is connected to the multigas unit. If a value outside this range is set, the mode changes to AUTO.

1. Display the SAMPLING page of the GAS window.
   Press [Menu] key → GAS key → SAMPLING tab.

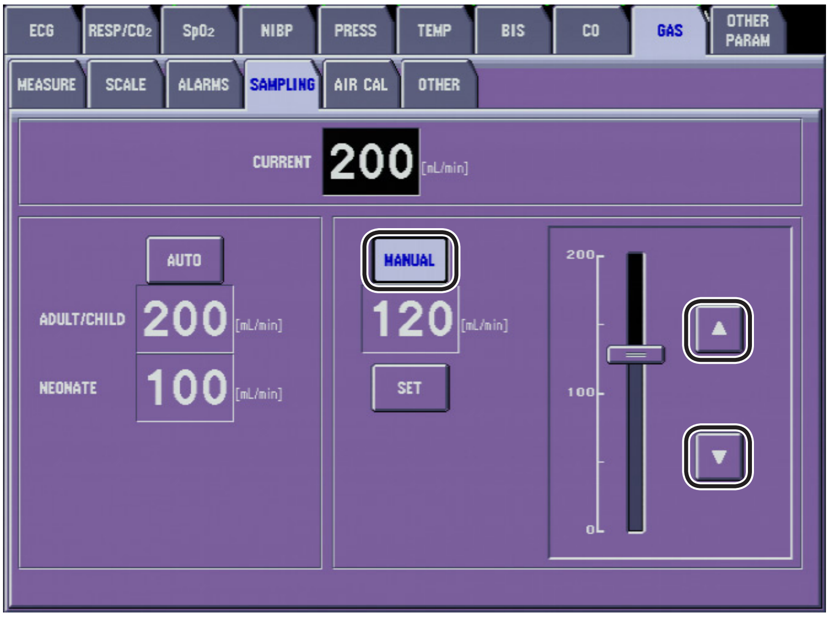
2. In Auto mode:
   Touch the AUTO key.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
CURRENT
200 [mL/min]
AUTO
ADULT/CHILD
200 [mL/min]
NEONATE
100 [mL/min]
MANUAL
120 [mL/min]
SET
200
100
0
▲
▼

In Manual mode:

i) Touch the MANUAL key.

ii) Touch or drag the slider to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.


ECG
RESP/CO₂
SpO₂
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
AUTO
MANUAL
SET
200
100
0
▲
▼

CURRENT 200 [mL/min]

ADULT/CHILD 200 [mL/min]

NEONATE 100 [mL/min]

120 [mL/min]

iii) Touch the SET key.

3. Press the [Home] key to return to the home screen.

Performing Zero Calibration

This setting is not available when using a Dräger Medical Primus/Fabius® anesthesia workstation.

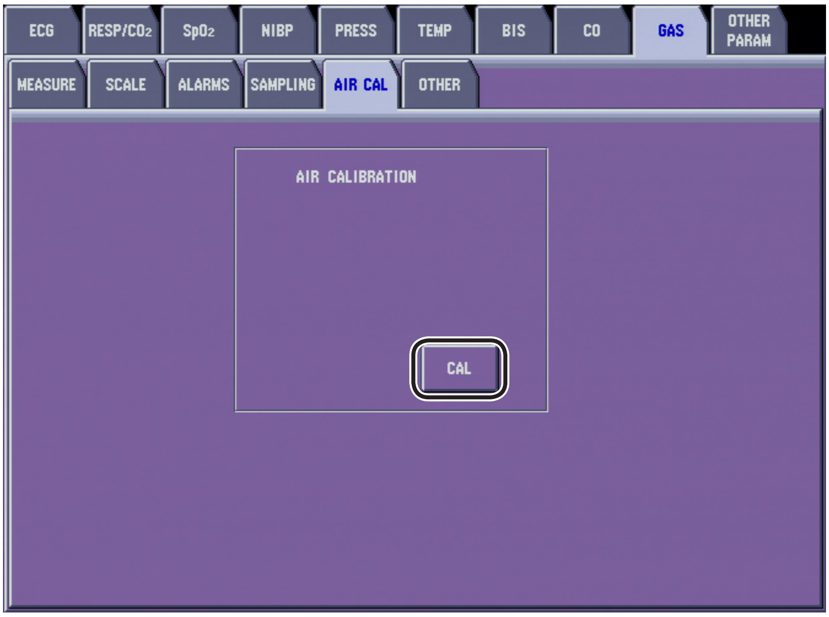
The monitor periodically performs the zero calibration with air.

When using a AG-920R or GF-110PA multigas unit or GF-120PA multigas/flow unit, manually perform the zero calibration when inappropriate measurement data appears and before performing gas calibration. It takes about 5 seconds for the zero calibration to complete.

When using a GF-210R multigas unit or GF-220R multigas/flow unit, manually perform the zero calibration when inappropriate measurement data appears. It takes about 1 minute for the zero calibration to complete.

1. Display the AIR CAL page of the GAS window.
   Press [Menu] key → GAS key → AIR CAL tab.

2. Touch the CAL key. Calibration is complete when the “CALIBRATING” message appears.

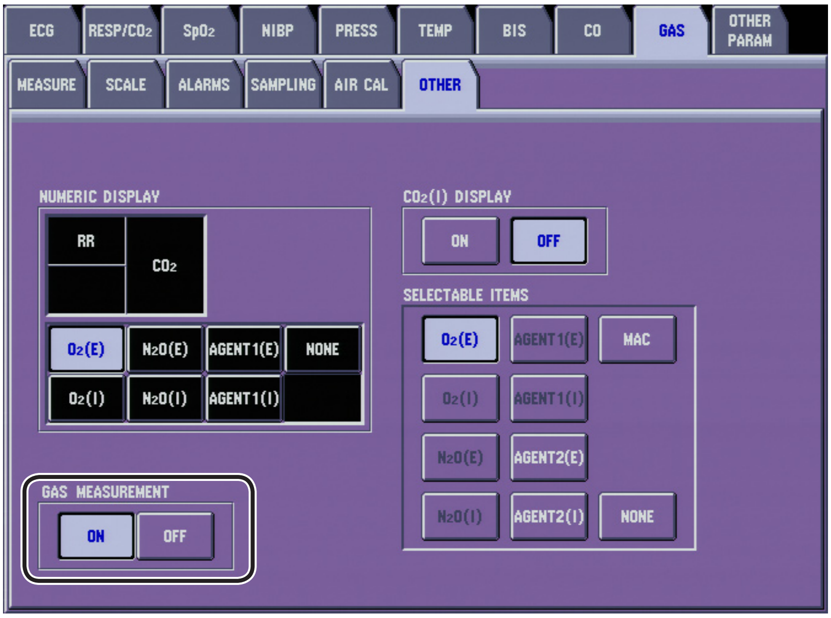

ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
AIR CALIBRATION
CAL

3. Press the [Home] key to return to the home screen.

Turning Gas Measurement On or Off

Gas measurement can be turned off only when using a GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit.

1. Display the OTHER page of the GAS window.
   Press [Menu] key → GAS key → OTHER tab.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
NUMERIC DISPLAY
RR
CO2
O2(E)
N2O(E)
AGENT1(E)
NONE
O2(I)
N2O(I)
AGENT1(I)
CO2(I) DISPLAY
ON
OFF
SELECTABLE ITEMS
O2(E)
AGENT1(E)
MAC
O2(I)
AGENT1(I)
N2O(E)
AGENT2(E)
N2O(I)
AGENT2(I)
NONE
GAS MEASUREMENT
ON
OFF

2. Select ON or OFF in the <GAS MEASUREMENT> box to turn gas measurement on or off.

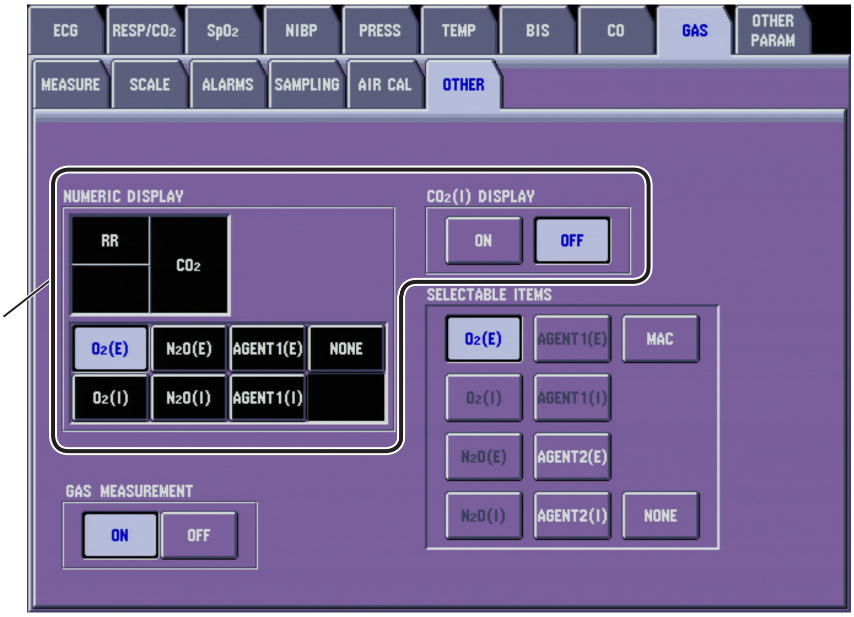
3. Press the [Home] key to return to the home screen.

Selecting the Parameters to be Displayed on the Home Screen

Up to 8 parameters can be displayed on the home screen. RR and CO_2(E) are always displayed. CO_2(I) display can be turned off independently of other items.

1. Display the OTHER page of the GAS window.
   Press [Menu] key → GAS key → OTHER tab.

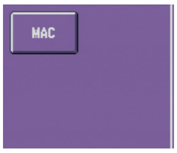
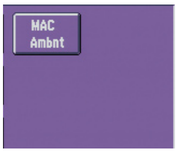
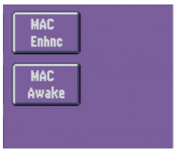
2. Select the parameters to be displayed from the <SELECTABLE ITEMS> box.


ECG
RESP/CO2
SpO2
NIBP
PRESS
TEMP
BIS
CO
GAS
OTHER PARAM
MEASURE
SCALE
ALARMS
SAMPLING
AIR CAL
OTHER
NUMERIC DISPLAY
RR
CO2
O2(E)
N2O(E)
AGENT1(E)
NONE
O2(I)
N2O(I)
AGENT1(I)
CO2(I) DISPLAY
ON
OFF
SELECTABLE ITEMS
O2(E)
AGENT1(E)
MAC
O2(I)
AGENT1(I)
N2O(E)
AGENT2(E)
N2O(I)
AGENT2(I)
NONE
GAS MEASUREMENT
ON
OFF

Displaying area on the home screen

This screen example is when the NUMERIC PARAMETER AREA setting on the LAYOUT page of the SYSTEM window in the SYSTEM SETUP window is set to “SIDE + SMALL BOTTOM” or “SIDE + LARGE BOTTOM”. The screen layout depends on the NUMERIC PARAMETER AREA setting. Refer to Section 3, Administrator’s Guide.

When connecting the GF-110PA or GF-210R multigas unit or GF-120PA or GF-220R multigas/flow unit, the selectable items depend on the MAC setting on the GAS page of the PARAMETERS window in the SYSTEM SETUP window. Refer to Section 3, Administrator’s Guide. The ambient pressure corrected MAC and enhanced MAC correction settings are not available for BSM-6000A series.

MAC setting		
UNCORRECTED	AMBIENT PRESSURE CORRECTED	ENHANCED
		 MAC Enhnc MAC Awake

3. Press the [Home] key to return to the home screen.

Performing Gas Calibration

CAUTION

When the monitoring value is not appropriate, perform gas calibration. Perform gas calibration once a year for stable measuring accuracy.

For stable measurement accuracy, perform gas calibration every year and whenever you suspect the monitor is not reading correctly when using an AG-920R or GF-110PA multigas unit or GF-120PA multigas/flow unit. For details, refer to the Service Manual.

Section 11 O_2 Monitoring

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Preparing for O_2 Monitoring 11.3
    Preparation Flowchart 11.3
    Oxygen Sensor and Connection Cord 11.3
    Connecting the Oxygen Sensor to the Unit 11.3
    Calibrating the O_2 Sensor 11.4
        Calibration with Air (Simple method) 11.4
        Calibration with 100% O_2 (Precise Method) 11.5
    Connecting the Oxygen Sensor to the Inspiration Circuit and Starting Measurement 11.7
Monitoring O_2 .... 11.8
    O_2 Information on the Home Screen 11.8
Changing O_2 Settings 11.9
    Changing the O_2 Alarm Limits 11.9
Principle and Structure of Oxygen Sensor 11.10
    Structure of Oxygen Sensor 11.10
    Life Span of Oxygen Sensor 11.10
    Precautions when Using the Oxygen Sensor 11.11

General

To monitor O_2 (inspired oxygen concentration), attach the oxygen sensor (074705) to the patient's inspiration circuit and connect it to the MULTI socket on the unit.

The inspired oxygen concentration of the patient is continuously measured.

NOTE

O_2 cannot be monitored by using the MULTI socket on the AY-660P input unit.

Preparing for O_2 Monitoring

Preparation Flowchart

1. Connect the oxygen sensor to the FiO_2 connection cord and connect the FiO_2 connection cord to the MULTI socket on the unit.

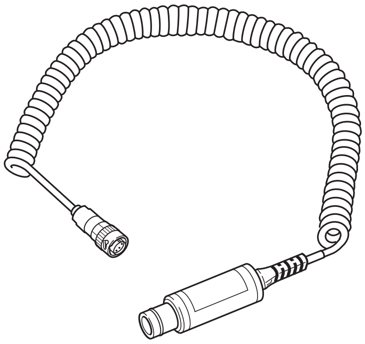
2. Calibrate the oxygen sensor.

3. Connect the oxygen sensor to the inspiration circuit of the patient.

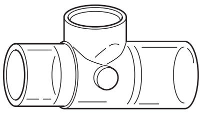
4. Start measurement (Start monitoring).

Oxygen Sensor and Connection Cord

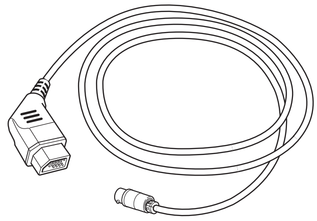
Oxygen sensor 074705



T-shaped adapter 110774

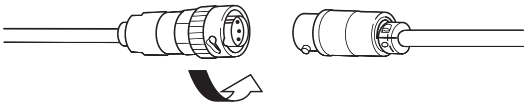


JO-900P FiO_2 connection cord



Connecting the Oxygen Sensor to the Unit

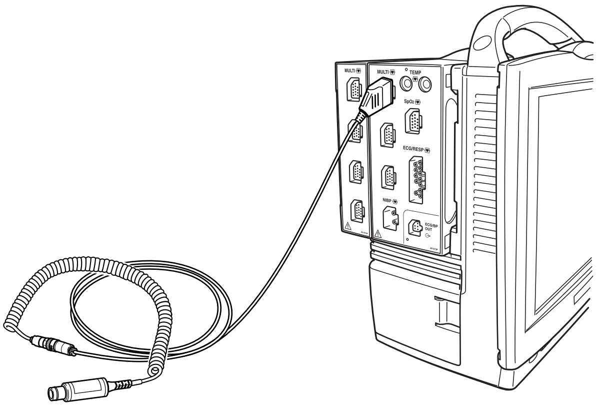
1. Connect the oxygen sensor to the FiO_2 connection cord.



NOTE

Rotate the ring until it clicks to lock it properly.

2. Connect the FiO_2 connection cord to the MULTI socket on the unit.



NOTE

O_2 cannot be monitored by using the MULTI socket on the AY-660P input unit.

Calibrating the O_2 Sensor

Perform calibration in the following cases.

- When starting measurement.
- When more than 24 hours have passed since the last calibration.
- When the oxygen sensor is disconnected from the FiO_2 connection cord and connected again.
- When the measured value seems to be incorrect.

CAUTION

The oxygen sensor must be stored with the detector facing down because the detector gets dry and FiO_2 monitoring cannot be performed properly. If the detector is dry, the oxygen sensor must be left with the detector facing down for 1 or 2 minutes. If the filter is completely dry, the oxygen sensor must be left with the detector facing down for more than 12 hours.

Calibration can be performed in two ways: air calibration and 100% O_2 calibration. Both methods are performed on the O_2 window.

- Calibration with air (simple method)
  Calibrates with air (21% O_2).
  The error margin of the measured value is 3%.
- Calibration with 100% O_2 (precise method)
  Calibrates with 100% O_2.
  The error margin of the measured value is 2%.

NOTE

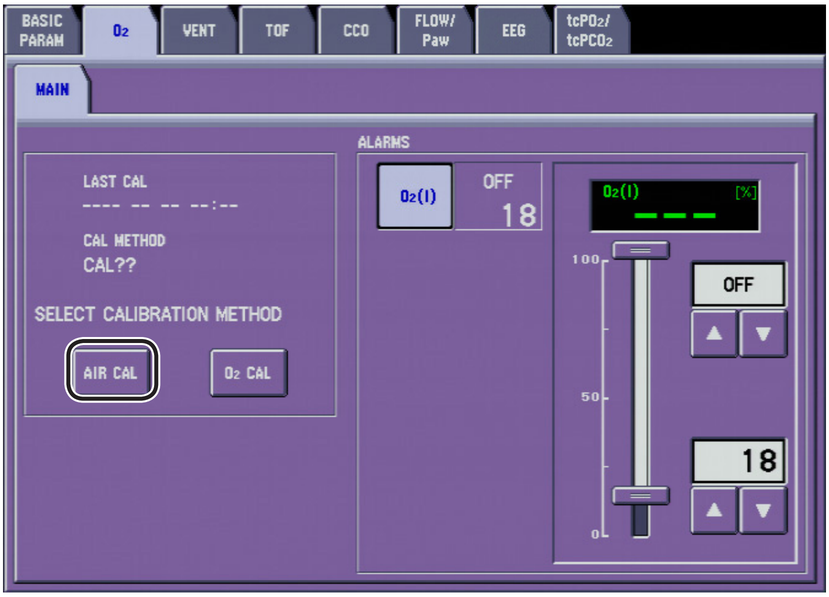
The calibrated value is saved in memory in the connector of the FiO_2 connection cord. Once calibrated, you don’t need to calibrate again when connecting the FiO_2 connection cord to the socket of a different unit.

Calibration with Air (Simple method)

1. Leave the oxygen sensor in the atmosphere for more than 1 minute.

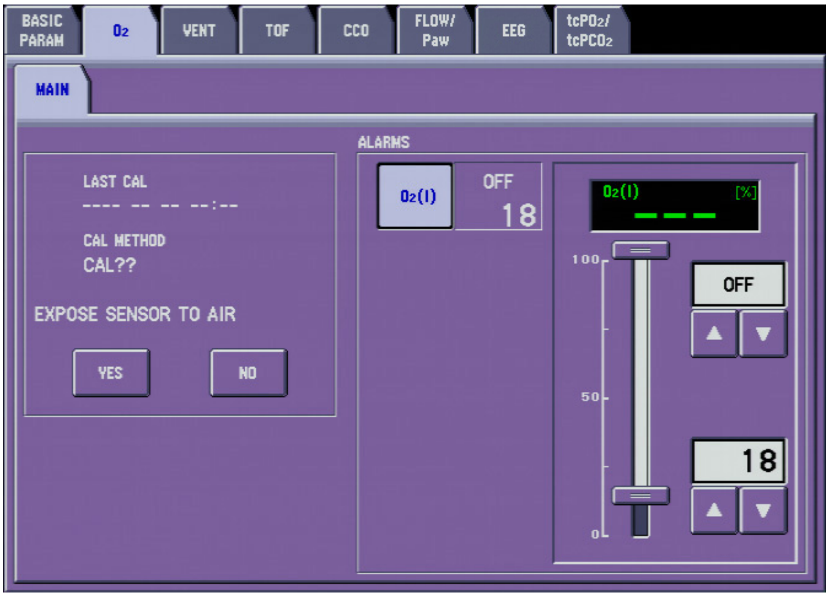
2. Display the MAIN page of the O_2 window.
   Press [Menu] key → O_2 key → MAIN tab.

3. Touch the AIR CAL key.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MAIN
ALARMS
O2(I)
OFF
18
O2(I)
[%]
100
50
0
OFF
18
AIR CAL
O2 CAL

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
SELECT CALIBRATION METHOD

4. When the “EXPOSE SENSOR TO AIR” message is displayed, touch the YES key to start calibration.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MAIN
ALARMS
O2(I)
OFF
18
O2(I)
[%]
100
50
0
OFF
18
YES
NO

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??
EXPOSE SENSOR TO AIR

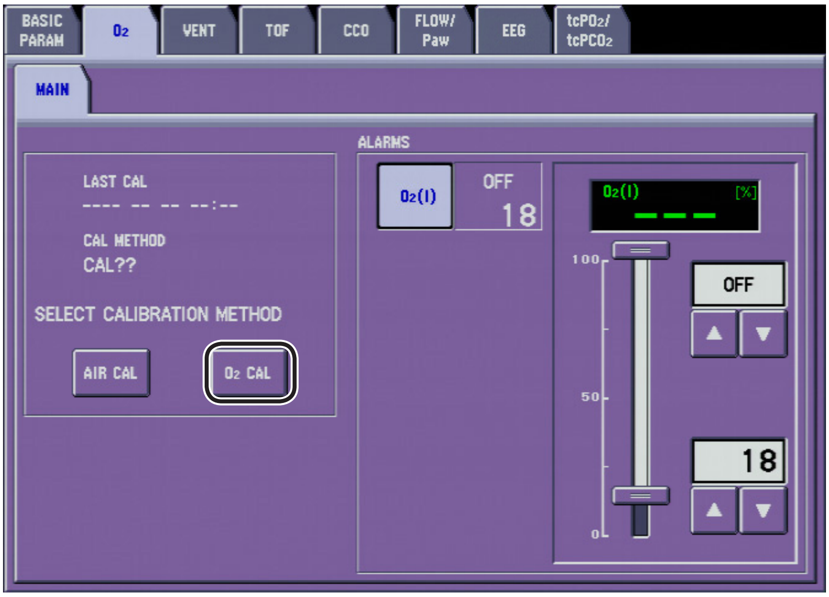
When calibration is complete, the calibration date and time, and the O_2 value ‘21’ are displayed on the O_2 window.

Calibration with 100% O_2 (Precise Method)

1. Apply 100% O_2 flow to the oxygen sensor for more than 1 minute.

2. Display the MAIN page of the O_2 window.
   Press [Menu] key → O_2 key → MAIN tab.

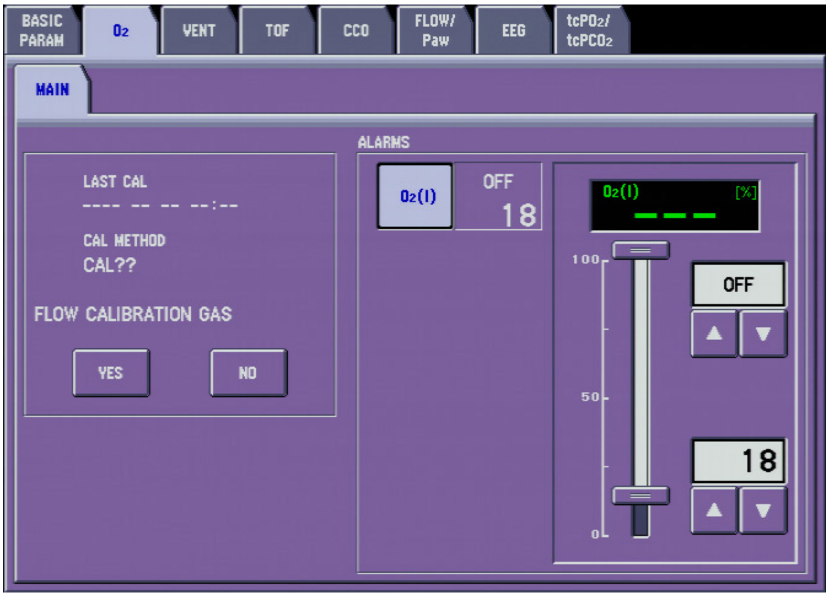
3. Touch the O_2 CAL key.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MAIN
ALARMS
O2(I)
OFF
18
O2(I) [%]
– – –
100
50
0
OFF
18
AIR CAL
O2 CAL

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??

SELECT CALIBRATION METHOD

4. When the “FLOW CALIBRATION GAS” message is displayed, touch the YES key to start calibration.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MAIN
ALARMS
O2(I)
OFF
18
O2(I) [%]
– – –
100
50
0
OFF
18
YES
NO

LAST CAL
---- -- -- --:--
CAL METHOD
CAL??

FLOW CALIBRATION GAS

When calibration is complete, the calibration date and time, and the O_2 value ‘100’ are displayed on the O_2 window.

Connecting the Oxygen Sensor to the Inspiration Circuit and Starting Measurement

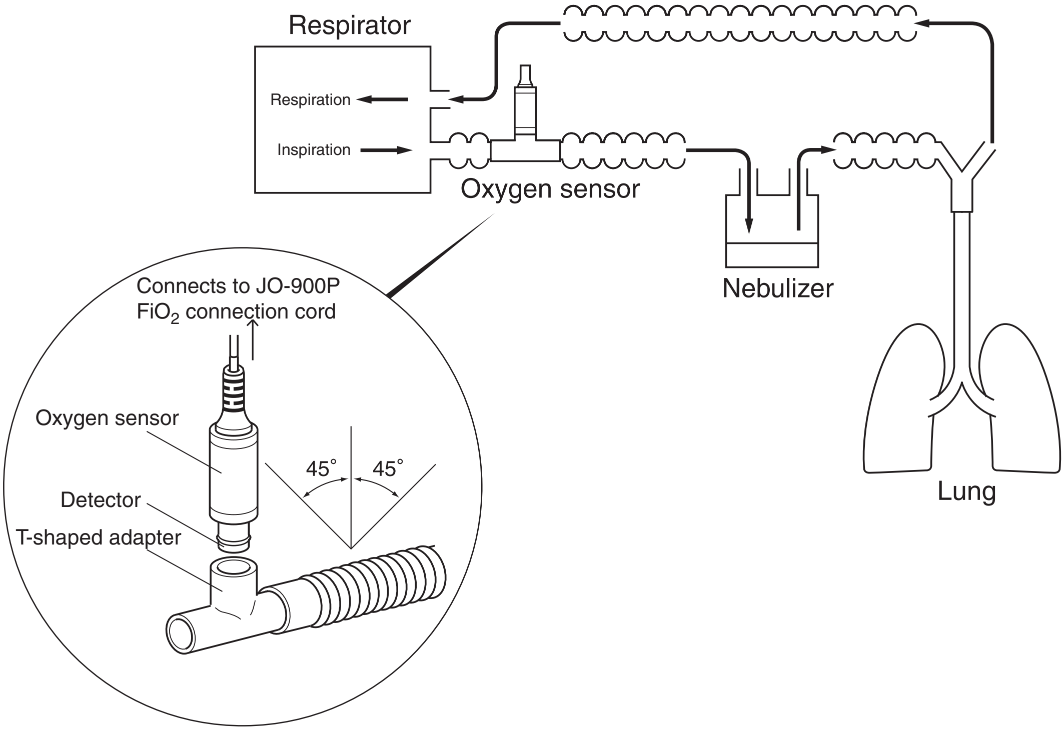
1. Connect the oxygen sensor to the T-shaped adapter.

2. Connect the T-shaped adapter properly to the inspiration circuit of the respirator, with the detector of the oxygen sensor facing down and the oxygen sensor at an inclination angle within 45° from the respirator vertically.

NOTE

- Connect the detector of the oxygen sensor facing down. Otherwise, the oxygen sensor function deteriorates and considerable errors in the measured value may occur.
- Do not connect the oxygen sensor where inspiration and expiration gas mix. The oxygen sensor cannot respond to each respiration.

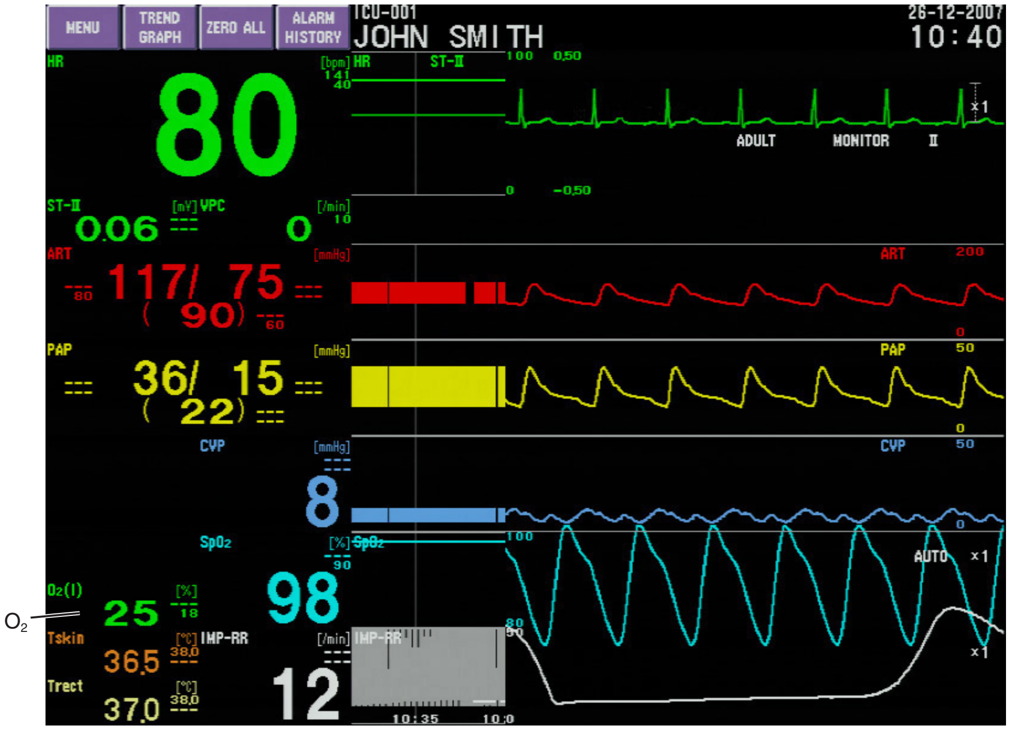
3. After connecting the oxygen sensor, you can start the O_2 monitoring.


Respirator
Respiration
Inspiration
Oxygen sensor
Nebulizer
Lung
Connects to JO-900P
FiO2 connection cord
Oxygen sensor
Detector
T-shaped adapter
45°
45°

Monitoring O_2

After completing the preparation, O_2 can be monitored.

O_2 Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
26-12-2007
10:40
HR
[bpm]
141
40
80
ST-II
[mV]
0.06
VPC
[/min]
10
0
ADULT
MONITOR
II
ART
[mmHg]
117/ 75
(90)
80
60
200
0
PAP
36/ 15
(22)
50
0
CVP
8
50
0
SpO2
[%]
90
98
100
80
AUTO
x1
O2(I)
[%]
25
18
Tskin
[°C]
36.5
38.0
Trect
[°C]
37.0
38.0
IMP-RR
[/min]
12
10:35
O2

Changing O_2 Settings

Change O_2 alarm settings on the O_2 window. The O_2 data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Changing the O_2 Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower O_2 alarm limits on the O_2 window. You can set all alarms, including the upper and lower O_2 alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I). You can also set upper and lower O_2 alarm limits on the GAS window.

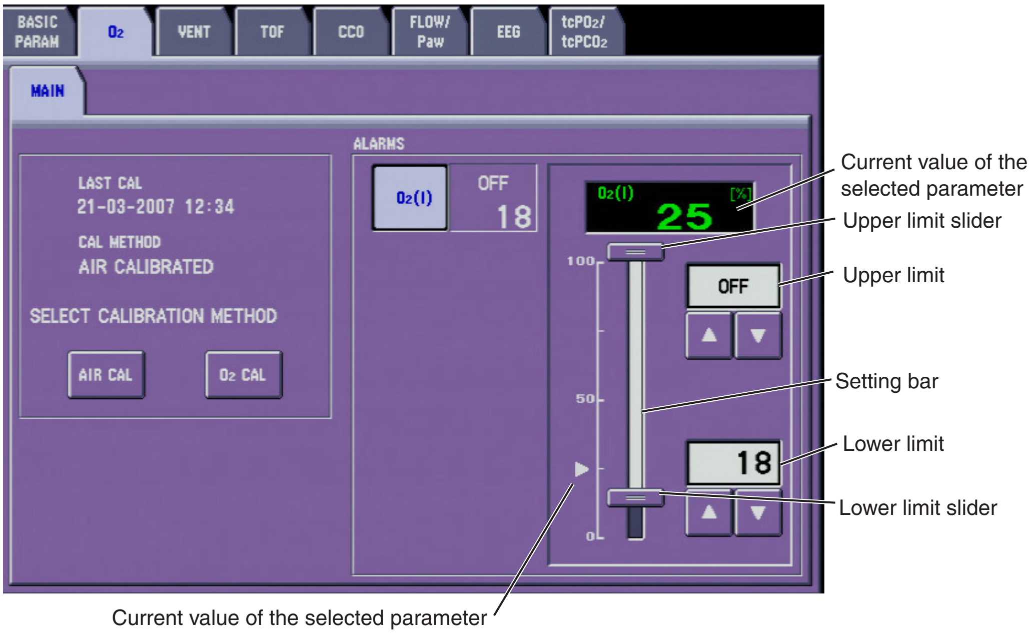
Setting Range

Upper limit: 19 to 100% in 1% steps, OFF (default setting: OFF)
Lower limit: 18 to 99% in 1% steps (default setting: 18%)

1. Display the MAIN page of the O_2 window.
   Press [Menu] key → O_2 key → MAIN tab.

2. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MAIN
ALARMS
SELECT CALIBRATION METHOD
AIR CAL
O2 CAL
O2(I)
OFF
18
O2(I) 25 [%]
100
50
0
OFF
▲ ▼
18
▲ ▼
Current value of the selected parameter
Upper limit slider
Upper limit
Setting bar
Lower limit
Lower limit slider
Current value of the selected parameter

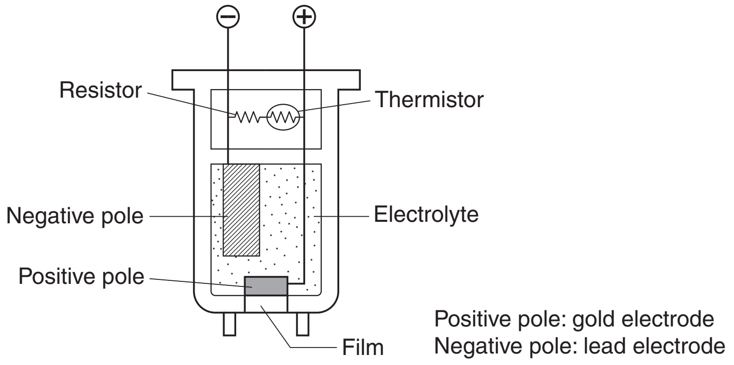
LAST CAL
21-03-2007 12:34
CAL METHOD
AIR CALIBRATED

3. Press the [Home] key to return to the home screen.

Principle and Structure of Oxygen Sensor

Structure of Oxygen Sensor

As shown below, the oxygen sensor is composed of an oxygen lead battery using special acidic electrolyte with the oxygen electrode (gold electrode) as the positive pole and the lead electrode as the negative pole. The oxygen in the measured air which passes through the non-multiparous fluorine-containing resin film and scatters, is electrolytically reduced at the gold electrode. A current proportional to the oxygen concentration in the atmosphere flows between the two electrodes. This current is detected as the terminal voltage of the resistor and thermistor for temperature compensation, and the oxygen concentration can be measured from the change in the output voltage. (See the graph below.)

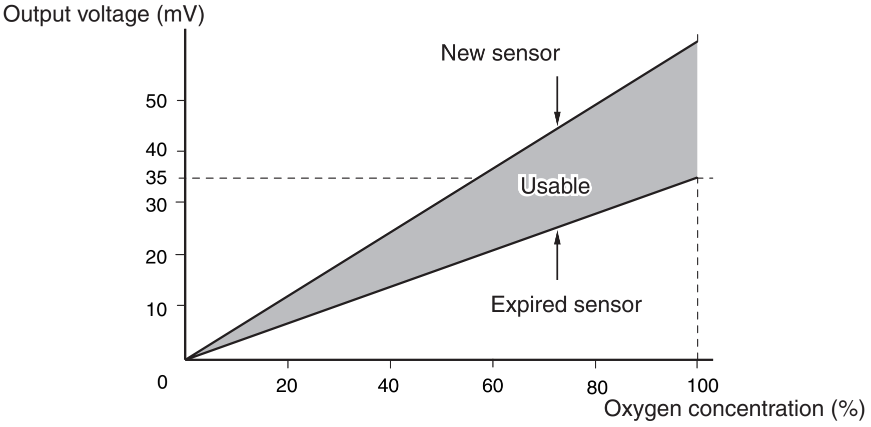


Life Span of Oxygen Sensor

The oxygen sensor wears out after a certain period of time because it is an oxygen battery which generates voltage in reaction to the oxygen in the atmosphere. Its life span depends on the oxygen concentration of the measured atmosphere, and will be shorter when used in places with high oxygen concentration, and longer in places with low oxygen concentration. Since the oxygen sensor outputs voltage proportionate to the oxygen concentration, it has reached the end of its life span when the output voltage can no longer be obtained.

As shown in the below graph, as it nears the end of its life, the output voltage becomes smaller. When the output voltage of the sensor during 100% O_2 calibration is below 35 mV, it is determined to have reached the end of its life.

Life of Sensor Oxygen



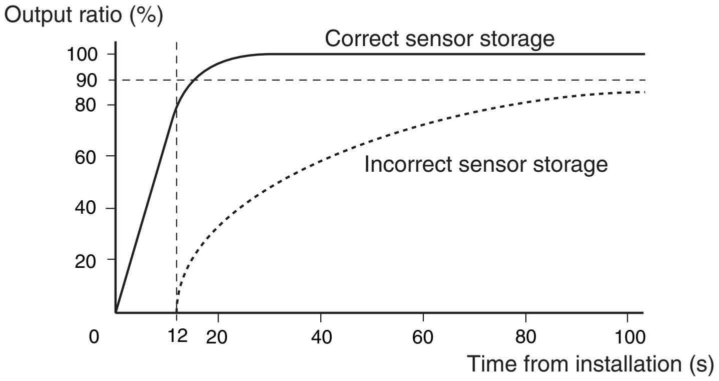
Precautions when Using the Oxygen Sensor

The electrolyte in the oxygen sensor contains air bubbles to protect the film and internal sensor parts from changes in the external voltage of the sensor (changes in atmospheric pressure). It serves as the buffer against pressure. For this reason, if the detector is not face down in use, these air bubbles will adhere to the film and electrodes and interfere with electrolytic response in the sensor, disabling correct measurement. Therefore, the detector of the oxygen sensor must be face down and at an inclination of within 45° vertically in use and storage. Leaving the detector face up will disable correct measurements for several minutes after the start of measurements.

When using an oxygen sensor not stored with the detector face down, face the detector down, leave it for several minutes to 12 hours, then perform calibration after the sensor output stabilizes.

The time for the sensor output to stabilize depends on the storage conditions. Refer to the graph below.

Time required for the sensor output to stabilize



Section 12 Ventilator Monitoring

General 12.2
    Monitoring Parameters and Settings 12.2
Preparing for Ventilator Parameter Monitoring 12.3
Monitoring Ventilator Parameters 12.4
    Ventilator Information on the Home Screen 12.5
    Ventilator Information on the VENT Window 12.5
Changing Ventilator Settings 12.6
    Checking the Ventilator Settings 12.6
    Changing the FLOW and Paw Scale 12.7
    Selecting the Ventilator Parameters to be Displayed on the Home Screen 12.7

General

The measured data acquired by a ventilator can be displayed on the bedside monitor when the ventilator is connected to the monitor with the QF series interface or IF series communication cable. The measured values, waveforms, settings on the ventilator and alarm can be displayed on the bedside monitor screen.

NOTE

A Dräger Medical Primus/Fabius® anesthesia workstation cannot be used with any of the following external instruments.

- AG-920R multigas unit
- GF-110PA/GF-210R multigas unit
- GF-120PA/GF-220R multigas/flow unit
- Ventilator

Monitoring Parameters and Settings

The parameters and settings that can be displayed on the monitor screen depend on the ventilator type as shown below.

Yes: displayed No: not displayed

Terms	Description	Unit	Ventilator Type				
			Dräger	Puritan Bennett	Puritan Bennett 7200	MAQUET	HAMILTON
FLOW	Respiratory flow rate	L/min	Yes	No	No	Yes	Yes
Paw	Airway pressure	cmH_2O*	Yes	No	No	Yes	Yes
Mode	Ventilation mode	—	Yes	Yes	Yes	Yes	Yes
Ppeak	Peak airway pressure	cmH_2O*	Yes	Yes	Yes	Yes	Yes
Pplat	Plateau pressure	cmH_2O*	Yes	Yes	Yes	Yes	Yes
Pmean	Mean airway pressure	cmH_2O*	Yes	Yes	Yes	Yes	Yes
PEEP	Positive end expiratory pressure	cmH_2O*	Yes	No	No	Yes	Yes
Pmin	Minimum airway pressure	cmH_2O*	Yes	No	No	No	Yes
CO_2(E)	End tidal CO_2 partial pressure	mmHg*	Yes	No	No	No	No
O_2(I)	Inspired oxygen	%	Yes	No	No	Yes	Yes
TEMP	Airway temperature	°C*	Yes	No	No	No	No
C	Compliance	mL/cmH_2O*	Yes	No	No	No	Yes
R	Resistance	cmH_2O*/L/s	Yes	No	No	No	Yes
RR	Respiration rate	/min	Yes	Yes	Yes	Yes	Yes
RRspo	Spontaneous respiration rate	/min	Yes	No	No	No	Yes
MV	Expiratory minute volume	L/min	Yes	Yes	Yes	Yes	Yes
MVspo	Spontaneous expiratory minute volume	L/min	Yes	Yes	Yes	No	No
TV	Tidal volume	L	Yes	Yes	Yes	Yes	Yes
Ppeak alarm limit	Peak airway pressure alarm setting	cmH_2O*	Yes	Yes	Yes	Yes	Yes
set PEEP	Positive end expiratory pressure setting	cmH_2O*	Yes	Yes	Yes	Yes	Yes

Terms	Description	Unit	Ventilator Type				
			Dräger	Puritan Bennett	Puritan Bennett 7200	MAQUET	HAMILTON
set FLOW	Respiratory flow rate setting	L/min	Yes	Yes	Yes	No	Yes
CO_2(E) upper limit	End tidal CO_2 partial pressure upper alarm limit	mmHg*	Yes	No	No	No	No
CO_2(E) lower limit	End tidal CO_2 partial pressure lower alarm setting	mmHg*	Yes	No	No	No	No
set O_2(I)	Inspired oxygen setting	%	Yes	Yes	Yes	Yes	Yes
RR alarm limit	Respiration rate alarm setting	/min	Yes	Yes	Yes	No	Yes
MV upper limit	Expiratory minute volume upper alarm setting	L/min	Yes	No	No	Yes	Yes
MV lower limit	Expiratory minute volume lower alarm setting	L/min	Yes	Yes	Yes	Yes	Yes
set TV	Tidal volume setting	mL	Yes	Yes	Yes	No	Yes
set I/E	Inspiration expiration ratio	—	Yes	Yes	No	No	Yes

* The temperature unit (°C or °F), CO_2 unit (mmHg or kPa) and respiration unit (cmH_2O or hPa) can be changed on the SYSTEM CONFIGURATION screen on the bedside monitor.

Preparing for Ventilator Parameter Monitoring

1. Connect the ventilator to the bedside monitor. Refer to the QF series interface or IF series communication cable manual.

2. Connect the ventilator to the patient. Refer to the ventilator manual.

3. Monitoring starts. Set necessary settings.

Monitoring Ventilator Parameters

After completing the preparation, ventilator data and waveforms appear on the screen.

WARNING

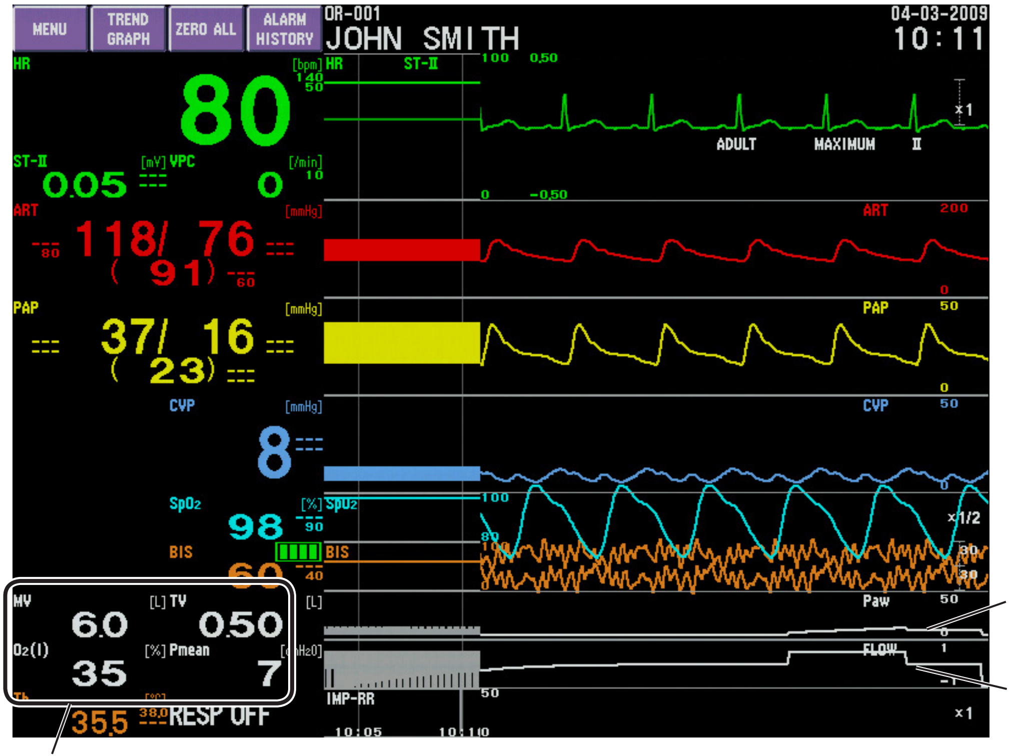
When connecting an external instrument using an interface or communication cable to the monitor, some alarms and messages from the external instrument might not be displayed on the monitor. When the waveform or data is abnormal, check the alarm and message on the external instrument.

When using the MAQUET ventilator, some ventilator alarms do not function on the bedside monitor. When the ventilator data on the bedside monitor is abnormal, check the alarm on the ventilator.

NOTE

- If a ventilator parameter is not monitored on the ventilator, it is not displayed on the bedside monitor.
- Some ventilator parameters cannot be displayed on the bedside monitor even if they are monitored on the ventilator.

Ventilator Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
OR-001
JOHN SMITH
04-03-2009
10:11
HR 80
ST-II 0.05
VPC 0
ART 118/ 76 (91)
PAP 37/ 16 (23)
CVP 8
SpO2 98
BIS 60
MV 6.0
TV 0.50
O2(I) 35
Pmean 7
RESP OFF
IMP-RR
ADULT
MAXIMUM
II
Paw
FLOW

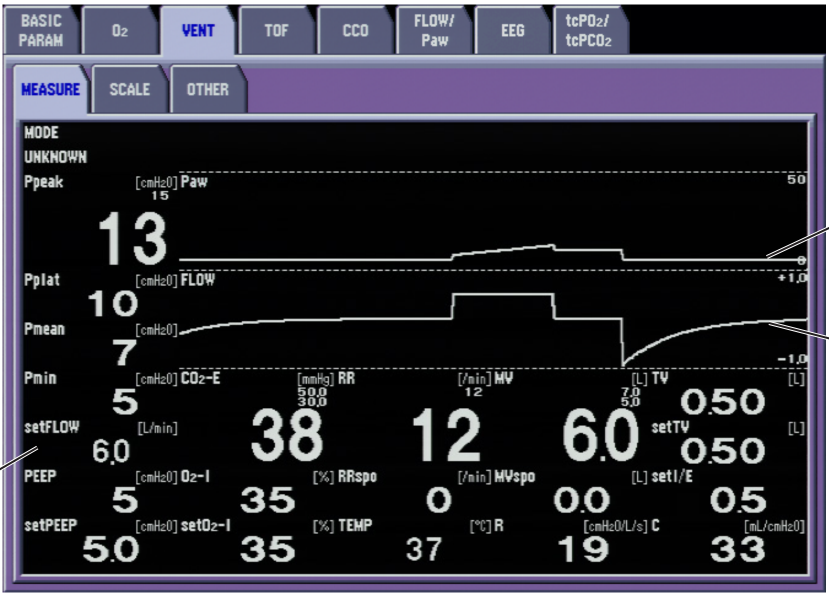
Paw waveform

Flow waveform

Ventilator parameters

Up to 4 ventilator parameters selected on the OTHER page of the VENT window are displayed on the home screen. To change the displaying parameters, refer to the “Selecting Parameters to be Displayed on the Home Screen” section.

Ventilator Information on the VENT Window


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
OTHER
MODE
UNKNOWN
Ppeak 13
Pplat 10
Pmean 7
Pmin 5
setFLOW 60
PEEP 5
setPEEP 5.0
Paw
FLOW
CO2-E 38
RR 12
MV 6.0
TV 0.50
setTV 0.50
O2-I 35
RRspo 0
MVspo 0.0
setI/E 0.5
setO2-I 35
TEMP 37
R 19
C 33

Paw waveform

Flow waveform

Measured values and settings

Changing Ventilator Settings

The following settings can be checked or set for ventilator parameter monitoring.

- Check settings on the ventilator
- Scale for Flow and Paw waveforms
- Displaying ventilator parameters on the home screen

The display color for ventilator parameters can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Checking the Ventilator Settings

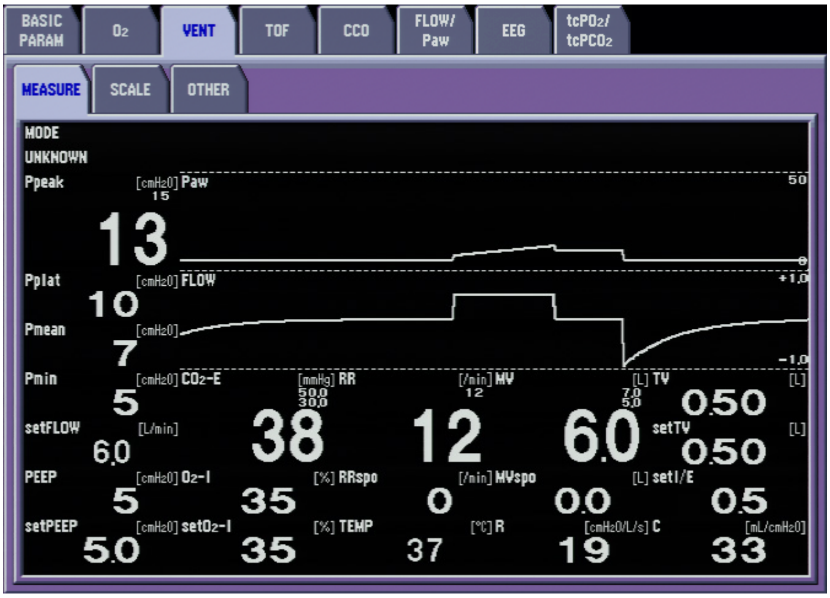
The following settings can be displayed on the VENT window.

Terms	Description	Unit
Ppeak alarm limit	Peak airway pressure alarm setting	cmH_2O*
set PEEP	Positive end expiratory pressure setting	cmH_2O*
set FLOW	Respiratory flow rate setting	L/min
CO_2(E) upper limit	End tidal CO_2 partial pressure upper alarm limit	mmHg*
CO_2(E) lower limit	End tidal CO_2 partial pressure lower alarm setting	mmHg*
set O_2(I)	Inspired oxygen setting	%
RR alarm limit	Respiration rate alarm setting	/min
MV upper limit	Expiratory minute volume upper alarm setting	L/min
MV lower limit	Expiratory minute volume lower alarm setting	L/min
set TV	Tidal volume setting	L
set I/E	Inspiration expiration ratio	—

* The respiration unit (cmH_2O or hPa) and CO_2 unit (mmHg or kPa) can be changed on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator's Guide.

1. Display the MEASURE page of the VENT window.
   Press [Menu] key → VENT key → MEASURE tab.

2. Check the settings.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
OTHER
MODE
UNKNOWN
Ppeak
[cmH2O] Paw
15
13
50
0
Pplat
[cmH2O] FLOW
10
+1.0
Pmean
[cmH2O]
7
-1.0
Pmin
[cmH2O] CO2-E
5
[mmHg] RR
50.0
30.0
38
[/min] MV
12
12
[L] TV
7.0
5.0
6.0
[L]
0.50
setFLOW
[L/min]
6.0
setTV
[L]
0.50
PEEP
[cmH2O] O2-I
5
35
[%] RRspo
0
[/min] MVspo
0.0
[L] setI/E
0.5
setPEEP
[cmH2O] setO2-I
5.0
35
[%] TEMP
37
[°C] R
19
[cmH2O/L/s] C
33
[mL/cmH2O]

3. Press the [Home] key to return to the home screen.

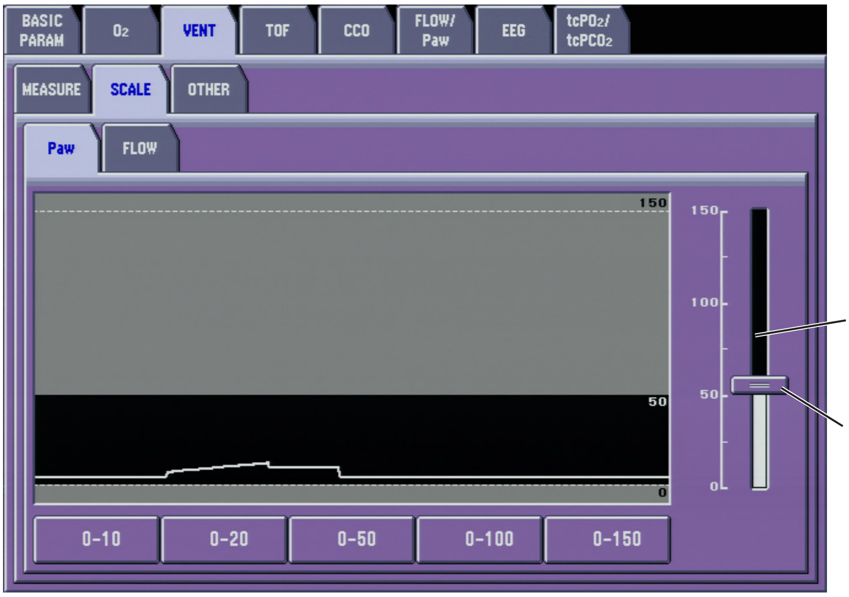
Changing the FLOW and Paw Scale

The scale can be changed for the FLOW and Paw waveforms. The same scale is used on both the home screen and VENT window.

1. Display the SCALE page of the VENT window.
   Press [Menu] key → VENT key → SCALE tab.

2. Touch the Paw tab to change the scale for the paw waveform.
   Touch the FLOW tab to change the scale for the flow waveform.

3. Select the scale. Adjust the scale with the sliders on the setting bar.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
OTHER
Paw
FLOW
150
50
0
150
100
50
0
0-10
0-20
0-50
0-100
0-150

Setting bar

Slider

4. Press the [Home] key to return to the home screen.

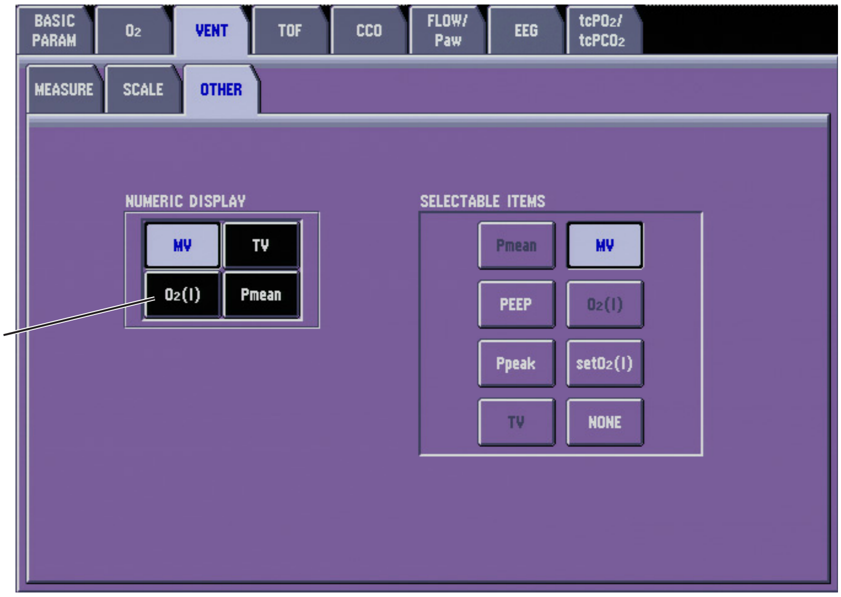
Selecting the Ventilator Parameters to be Displayed on the Home Screen

Up to 4 ventilator parameters can be displayed on the home screen.

1. Display the OTHER window of the VENT window.
   Press [Menu] key → VENT key → OTHER tab.

2. Select the area on the home screen where the parameter is to be displayed in the <NUMERIC DISPLAY> box.

3. Select the parameter to be displayed in the selected area from the <SELECTABLE ITEMS> box.


BASIC PARAM
O_2
VENT
TOF
CCO
FLOW/ Paw
EEG
$tcPO_2$/ $tcPCO_2$
MEASURE
SCALE
OTHER
NUMERIC DISPLAY
MV
TV
O_2(I)
Pmean
SELECTABLE ITEMS
Pmean
MV
PEEP
O_2(I)
Ppeak
setO_2(I)
TV
NONE
Displaying order on the home screen

4. Press the [Home] key to return to the home screen.

Section 13 TOF Monitoring

General 13.2
    List of Terms 13.2
Preparing for TOF Monitoring 13.3
Monitoring TOF 13.4
    TOF Information on the Home Screen 13.4
    Opening the TOF Window 13.4
    TOF Information on the TOF Window 13.5
    Recording the TOF Data 13.5

General

TOF monitoring is performed by connecting the Organon TOF-Watch® SX neuromuscular transmission monitor to the bedside monitor. To connect the TOF-Watch® SX, the QF-909P interface is required.

TOF-Watch SX is a registered trademark of N. V. Organon.

List of Terms

Item	Description	Unit
TOF rat	TOF ratio	%
TOF cnt	TOF counts	Times
PTC*	Twitch counts	Times
Temp	Body surface temperature	°C
Stim	Stimulation current	mA
Cal	Calibration current	mA
T	Pulse width	µs
Alarm	TOF alarm setting	% or times
Sens	Sensitivity of the transducer	—
TW1	Twitch height 1	%
TW2	Twitch height 2	%
TW3	Twitch height 3	%
TW4	Twitch height 4	%

* PTC is only displayed in PTC mode.

Preparing for TOF Monitoring

1. Connect the TOF-Watch® SX to the bedside monitor. Refer to the QF-909P interface manual.

2. Connect the TOF-Watch® SX to the patient. Refer to the TOF-Watch® SX manual.

3. Start monitoring.

4. If necessary, change settings on the TOF-Watch® SX. Refer to the TOF-Watch® SX manual.

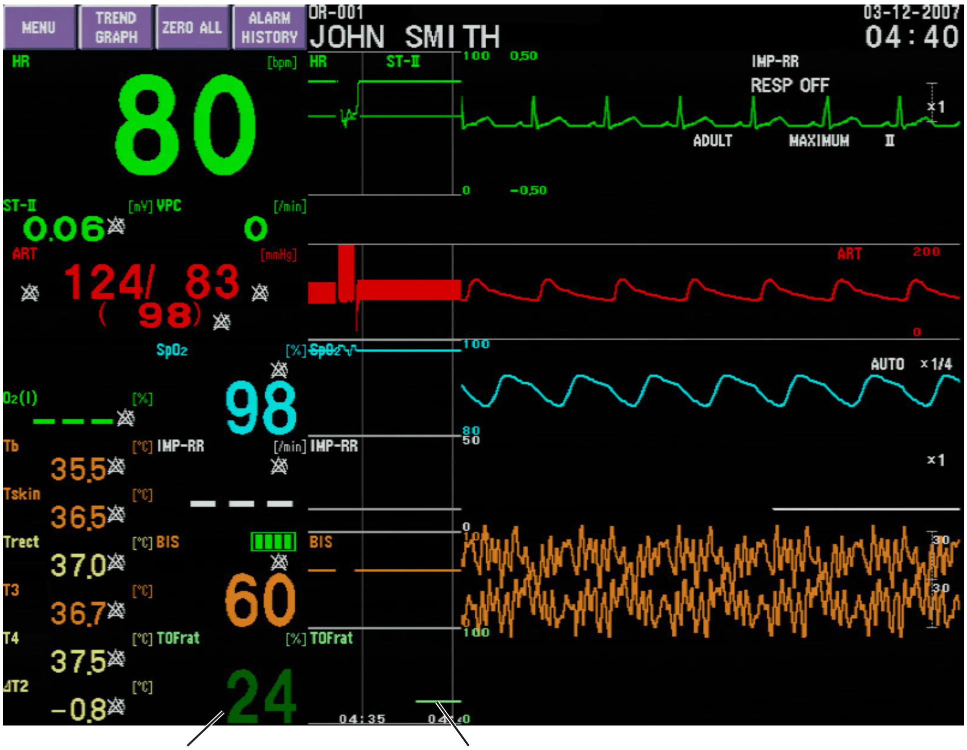
Monitoring TOF

After completing the preparation, TOF data appear on the screen.

WARNING

The TOF rat and TOF cnt alarms do not function on the bedside monitor when the TOF-Watch® SX is connected. When the TOF data on the bedside monitor is abnormal, check the alarm on the TOF-Watch® SX.

TOF Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
OR-001
JOHN SMITH
03-12-2007
04:40
HR [bpm]
80
ST-II [mV] VPC [/min]
0.06
0
ART [mmHg]
124/ 83
(98)
SpO2 [%]
98
O2(I) [%]
Tb [°C] IMP-RR [/min]
35.5
Tskin [°C]
36.5
Trect [°C] BIS
37.0
60
T3 [°C]
36.7
T4 [°C] TOFrat [%]
37.5
24
dT2 [°C]
-0.8
HR ST-II
100 0.50
0 -0.50
IMP-RR
RESP OFF
×1
ADULT MAXIMUM II
ART 200
0
SpO2 100
AUTO ×1/4
80
50
IMP-RR
×1
0
BIS
100
30
30
0
TOFrat
04:35
04:40

TOF rat

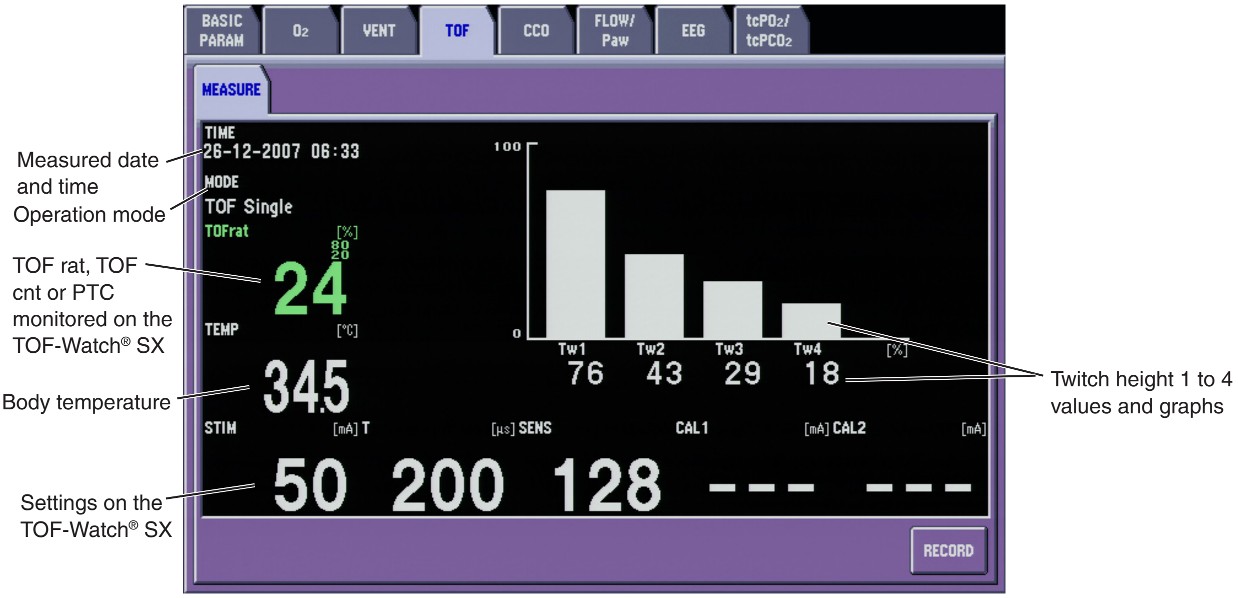
TOF rat trendgraph

Opening the TOF Window

To open the TOF window:
Press [Menu] key → TOF key → MEASURE tab.

The contents of the TOF window depend on the operation mode on the TOF-Watch® SX.

TOF Information on the TOF Window


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
Measured date and time
Operation mode
TOF rat, TOF cnt or PTC monitored on the TOF-Watch® SX
Body temperature
Settings on the TOF-Watch® SX
Twitch height 1 to 4 values and graphs
100
0
RECORD

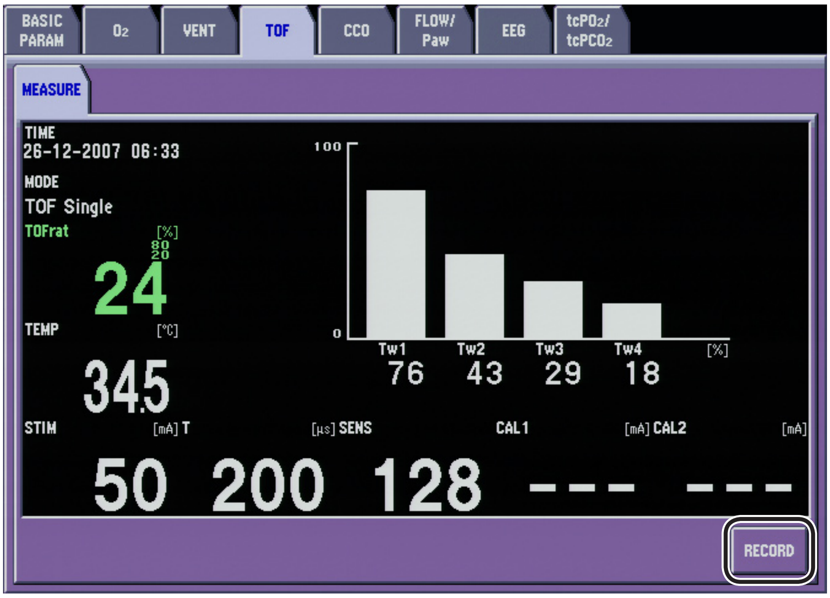
TIME 26-12-2007 06:33
MODE TOF Single
TOFrat [%] 80 20 24
TEMP [°C] 34.5
Tw1 76 Tw2 43 Tw3 29 Tw4 18 [%]
STIM [mA] 50 T [μs] 200 SENS 128 CAL1 --- [mA] CAL2 --- [mA]

Recording the TOF Data

TOF data on the TOF window can be recorded on the optional recorder.

1. Display the TOF window.
   Press [Menu] key → TOF key.

2. Touch the RECORD key. Recording starts.

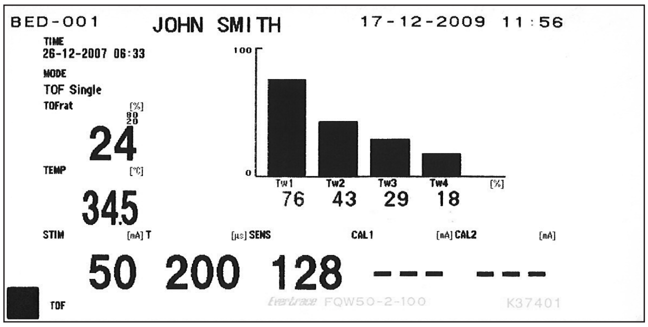

BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
100
0
RECORD

TIME 26-12-2007 06:33
MODE TOF Single
TOFrat [%] 80 20 24
TEMP [°C] 34.5
Tw1 76 Tw2 43 Tw3 29 Tw4 18 [%]
STIM [mA] 50 T [μs] 200 SENS 128 CAL1 --- [mA] CAL2 --- [mA]

To stop recording, press the [Record] key.

3. Press the [Home] key to return to the home screen.

Recording example



BED-001 JOHN SMITH 17-12-2009 11:56

TIME
26-12-2007 06:33

MODE
TOF Single

TOFrat [%]
80
20
24

TEMP [°C]
34.5

STIM [mA] T [μs] SENS CAL1 [mA] CAL2 [mA]
50 200 128 --- ---

TOF

Evertrace FQW50-2-100 K37401

100
0
Tw1
Tw2
Tw3
Tw4
[%]
76
43
29
18

Section 14 CCO Monitoring

- CCO Monitoring by CCO Monitor 14.2
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    - List of Terms 14.2
  - Preparing for CCO Monitoring 14.3
  - Monitoring CCO 14.3
    - CCO Information on the Home Screen 14.3
    - CCO Information on the CCO Window 14.4
    - Opening the CCO Window 14.4
    - Hemodynamics Table on the HEMO Page of the TREND Window 14.4
  - Changing the CCO Settings 14.5
    - Selecting the CCO Parameters to be Displayed on the Home Screen 14.5
- PCCO Monitoring by PiCCO *plus* or PiCCO2 Monitor 14.6
  - General 14.6
    - List of Terms 14.7
    - Monitoring Parameters and Settings 14.8
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  - Monitoring PiCCO 14.9
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    - Recording the PiCCO Data on the WAVEFORM Page of CCO Window 14.11
    - Hemodynamics Table on the HEMO Page of the TREND Window 14.12
  - Changing the PiCCO Setting 14.12
    - Changing the Scale of the AP Waveform on the WAVEFORM Page CCO Window 14.12
    - Selecting the Absolute or Index Value to be Displayed 14.13
- CCO/$S\bar{v}O_2$ Monitoring by SO_2/CCO Monitor 14.14
  - General 14.14
    - List of Terms 14.14
  - Preparing for CCO/$S\bar{v}O_2$ Monitoring 14.15
  - Monitoring CCO/$S\bar{v}O_2$ 14.15
    - CCO Information on the Home Screen 14.15
    - CCO/$S\bar{v}O_2$ Information on the CCO Window 14.16
    - Opening the CCO Window 14.16
    - Hemodynamics Table on the HEMO Page of the TREND Window 14.16
  - Changing the CCO/$S\bar{v}O_2$ Settings 14.17
    - Selecting the CCO/$S\bar{v}O_2$ Parameters to be Displayed on the Home Screen 14.17
- Explanation of Hemodynamics Data 14.18

CCO Monitoring by CCO Monitor

General

Continuous cardiac output monitoring can be performed by connecting an Edwards Lifesciences Vigilance oximeter/continuous cardiac output measuring device (CCO monitor) to the bedside monitor. To connect the CCO monitor to the bedside monitor, the QF-903P interface is required.

List of Terms

Label	Name	Unit
CCO	Continuous cardiac output	L/min
CCI	Continuous cardiac output index	L/min/m^2
$S\bar{v}O_2$*[1]	Mixed venous oxygen saturation	%
$ScvO_2$*[1]	Central venous oxygen saturation	%
Tb	Blood temperature	°C or °F*[2]
SV	Stroke volume	mL
SVV*[3]	Stroke volume variation	%
HR	Heart rate	bpm
SVR	Systemic vascular resistance	dyn•s/cm^5*[4]
SVRI	Systemic vascular resistance index	dyn•s•m^2/cm^5*[5]
ART-MEAN	Arterial mean pressure	mmHg*[2]
CVP	Central venous mean pressure	mmHg*[2]
EDV	End diastolic volume	mL
EDVI	End diastolic volume index	mL/m^2
ESV	End systolic volume	mL
ESVI	End systolic volume index	mL/m^2
EF	Ejection fraction	%
DO_2	Oxygen delivery	mL/min
VO_2	Oxygen consumption	mL/min
O_2EI	Oxygen extraction index	%
SaO_2	Arterial oxygen saturation	%
SQI	Signal quality index	—

*[1] $ScvO_2$ is displayed instead of $S\bar{v}O_2$ when it is monitored on the Vigilance II or Vigileo monitor.

*[2] The temperature unit (°C or °F) and blood pressure unit (mmHg or kPa) can be changed on the SYSTEM CONFIGURATION screen of the bedside monitor.

*[3] SVV is available only when the Vigileo monitor is used.

*[4] When the blood pressure unit is kPa, this unit becomes kPa•s/L.

*[5] When the blood pressure unit is kPa, this unit becomes kPa•s•m^2/L.

Preparing for CCO Monitoring

1. Set up the CCO monitor and connect it to the bedside monitor. Refer to the QF-903P interface manual.

2. Connect the CCO monitor to the patient. Refer to the CCO monitor manual.

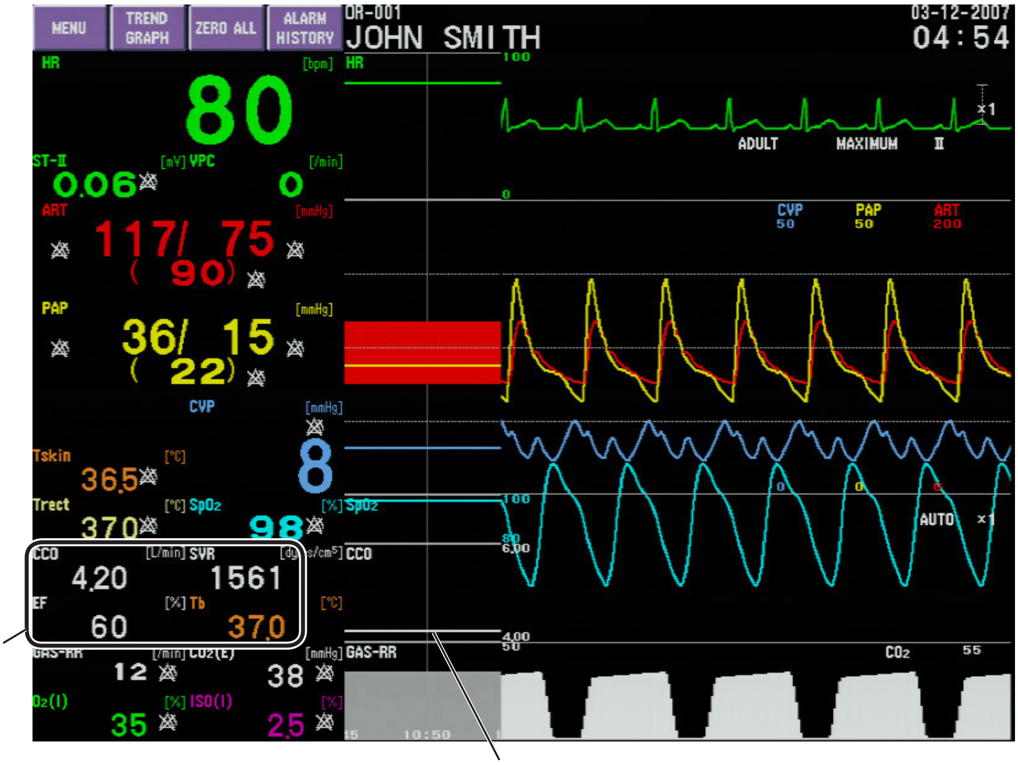
3. Start measurement and change necessary settings.

Monitoring CCO

After completing the preparation, CCO data appear on the screen.

CCO Information on the Home Screen

EF, Tb (Ext), CCO, $S\bar{v}O_2$ ($ScvO_2$), EDV:	Data monitored on the CCO monitor.
EDVI, SVR, SVRI, CCI:	Calculated from the data monitored on the CCO monitor and bedside monitor.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
OR-001
JOHN SMITH
03-12-2007
04:54
HR [bpm] 80
ST-II [mV] 0.06
VPC [/min] 0
ART [mmHg] 117/ 75 (90)
PAP [mmHg] 36/ 15 (22)
CVP [mmHg] 8
Tskin [°C] 36.5
Trect [°C] 37.0
SpO2 [%] 98
CCO [L/min] 4.20
SVR [dyn·s/cm5] 1561
EF [%] 60
Tb [°C] 37.0
GAS-RR [/min] 12
CO2(E) [mmHg] 38
O2(I) [%] 35
ISO(I) [%] 2.5
ADULT
MAXIMUM
II
CVP 50
PAP 50
ART 200
AUTO
×1
CO2 55
10:50

CCO parameters

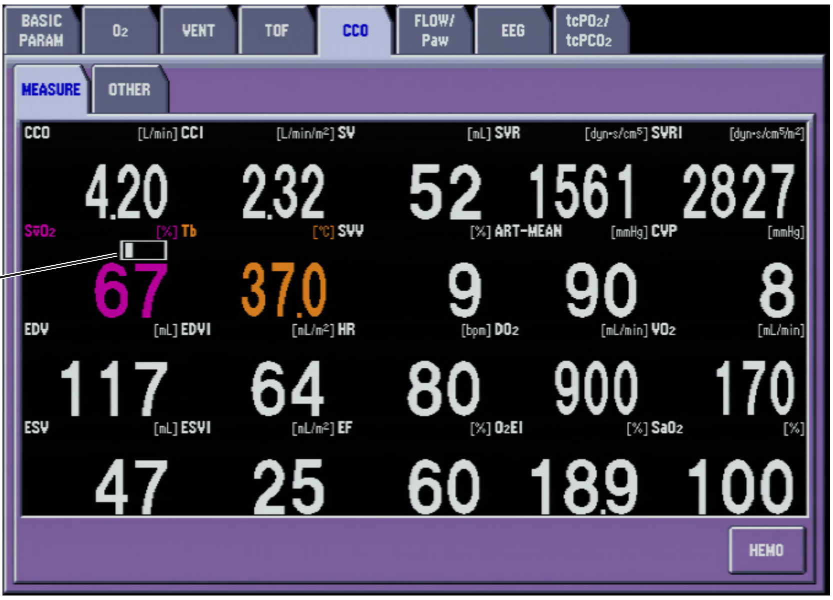
CCO trendgraph

Up to 4 CCO parameters selected on the OTHER page of the CCO window are displayed on the home screen. To change the displaying parameters, refer to the “Selecting CCO Parameters to be Displayed on the Home Screen” section.

CCO Information on the CCO Window

CCO, $S\bar{v}O_2$ ($ScvO_2$), Tb, SQI, SVV, EDV, ESV, EF, DO_2, VO_2, O_2EI, SaO_2:
Data monitored on the CCO monitor.

HR, ART-MEAN, CVP:	Data monitored on the bedside monitor.
CCI, SV, SVR, SVRI, EDVI, ESVI:	Calculated from the data monitored on the CCO monitor and bedside monitor.



CCO [L/min]	CCI [L/min/m^2]	SV [mL]	SVR [dyn·s/cm^5]	SVRI [dyn·s/cm^5/m^2]
4.20	2.32	52	1561	2827
$S\bar{v}O_2$ [%]	Tb [°C]	SVV [%]	ART-MEAN [mmHg]	CVP [mmHg]
67	37.0	9	90	8
EDV [mL]	EDVI [mL/m^2]	HR [bpm]	DO_2 [mL/min]	VO_2 [mL/min]
117	64	80	900	170
ESV [mL]	ESVI [mL/m^2]	EF [%]	O_2EI [%]	SaO_2 [%]
47	25	60	18.9	100

SQI bar graph

$S\bar{v}O_2$ ($ScvO_2$) SQI is indicated in 4 levels.

Good	▯▯▯▯
Medium	▯▯▯▮
Poor	▯▯▮▮
Invalid	▯▮▮▮

Opening the CCO Window

To open the CCO window:

Press [Menu] key → CCO key → MEASURE tab.

Hemodynamics Table on the HEMO Page of the TREND Window

When cardiac output is monitored by the CCO monitor, the CO data is listed on the HEMO page of the TREND window. When CO is monitored, the CO and CI are also added to this list. For details on the HEMO page, refer to Section 6 of the User's Guide Part I.

CO:	Data monitored on the CCO monitor.
CI:	Calculated from the data monitored on the CCO monitor and bedside monitor.

The CCO parameters:	CCO, CCI, SVR, SVRI, SVV, $S\bar{v}O_2$, $ScvO_2$,, EDV, EDVI, ESV, ESVI, EF are listed on the TABLE page of the TREND window.
The CCO parameters:	CCO, CCI, SVRI, SVV, $S\bar{v}O_2$, $ScvO_2$,, EDV are listed on the GRAPH page of the TREND window.

Changing the CCO Settings

Displaying CCO parameters on the home screen can be set on the CCO window.

The display color for CCO can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

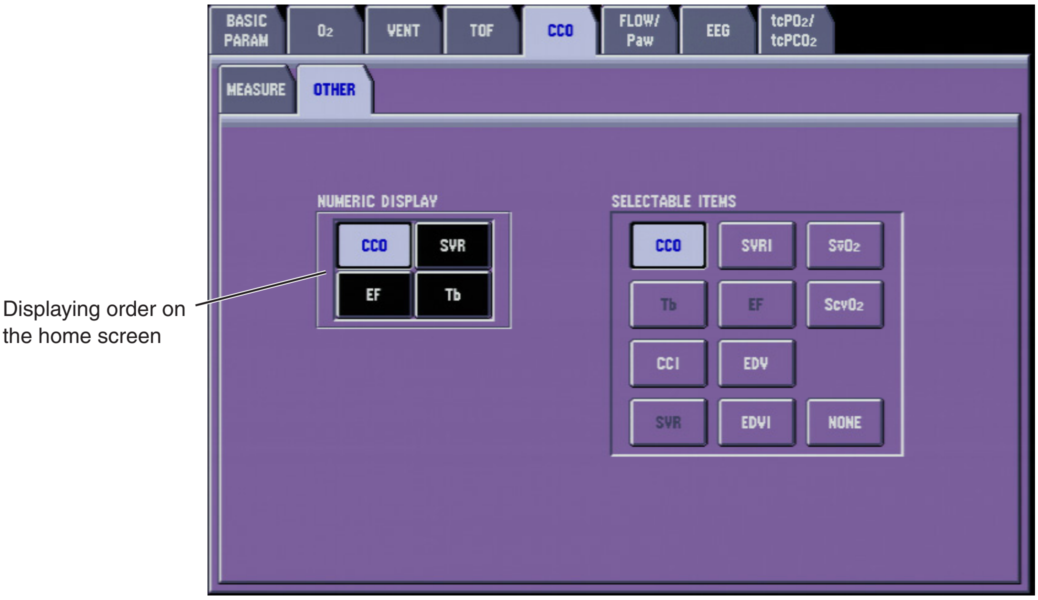
Selecting the CCO Parameters to be Displayed on the Home Screen

Up to 4 CCO parameters can be displayed on the home screen.

1. Display the OTHER page of the CCO window.
   Press [Menu] key → CCO key → OTHER tab

2. Select the area for the parameter to be displayed on the home screen in the <NUMERIC DISPLAY> box.

3. Select the parameter to be displayed in the selected area from the <SELECTABLE ITEMS> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
OTHER
NUMERIC DISPLAY
CCO
SVR
EF
Tb
SELECTABLE ITEMS
CCO
SVRI
SvO2
Tb
EF
ScvO2
CCI
EDV
SVR
EDVI
NONE
Displaying order on the home screen

4. Press the [Home] key to return to the home screen.

PCCO Monitoring by PiCCO *plus* or PiCCO2 Monitor

General

Pulse contour cardiac output monitoring can be performed by connecting a Pulsion Medical Systems PiCCO *plus* or PiCCO2 monitor (PiCCO monitor) to the bedside monitor. To connect the PiCCO monitor to the bedside monitor, a QF-911P interface is required.

CAUTION

Connect the PiCCO monitor to the BSM-6000 series bedside monitor using only the QF-911P interface. Do not connect the instruments using any other interface or cable. Otherwise, the measurement accuracy becomes out of range.

NOTE

- Only the PiCCO *plus* monitor with protocol version SP 7.0 or later and PiCCO2 monitor with protocol version V3.0 or V1.0 is compatible with the BSM-6000 series bedside monitors.
- If a PiCCO parameter is not monitored on the PiCCO monitor, it is not displayed on the bedside monitor.
- Some PiCCO parameters cannot be displayed on the bedside monitor even if they are monitored on the PiCCO monitor.

List of Terms

Label	Name	Unit
PCCO	Pulse contour cardiac output	L/min
PCCI	Pulse contour cardiac output index	L/min/m^2
SV	Stroke volume	mL
SVI	Stroke volume index	mL/m^2
SVR	Systemic vascular resistance	dyn•s/cm^5*[3]
SVRI	Systemic vascular resistance index	dyn•s•m^2/cm^5*[4]
SVV	Stroke volume variation	%
PPV	Pulse pressure variation	%
dPmax*[5]	Left ventricular contractility index	mmHg*[1]/s
Tb	Blood temperature	°C or °F*[1]
PR	Pulse rate	bpm
AP	Arterial pressure (systolic/diastolic (mean))	mmHg*[1]
CO	Cardiac output	L/min
CI	Cardiac output index	L/min/m^2
GEDV	Global end diastolic volume	mL
GEDVI	Global end diastolic volume index	mL/m^2
ITBV	Intrathoracic blood volume	mL
ITBVI	Intrathoracic blood volume index	mL/m^2
GEF*[5]	Global ejection fraction	%
CFI	Cardiac function index	/min
EVLW	Extravascular lung water	mL
EVLWI	Extravascular lung water index	mL/kg
PVPI*[5]	Pulmonary vascular permeability index	—
Time	Measurement time	—
Height*[2]	Height	cm
Weight*[2]	Weight	kg
ScvO$_2$*[5]*[6]	Central venous oxygen saturation	%
DO$_2$*[5]*[6]	Oxygen delivery	mL/min
DO$_2$I*[5]*[6]	Oxygen delivery index	mL/min/m^2
VO$_2$*[5]*[6]	Oxygen consumption	mL/min
VO$_2$I*[5]*[6]	Oxygen consumption index	mL/min/m^2
CPO*[5]*[6]	Cardiac power output	W
CPI*[5]*[6]	Cardiac power index	W/m^2
SpO$_2$*[5]*[6]	Arterial oxygenation saturation (pleth)	%
PDR*[5]*[6]	Plasma disappearance rate	%/min
R15*[5]*[6]	Retention rate of ICG	%

*[1] The temperature unit (°C or °F) and blood pressure unit (mmHg or kPa) can be changed on the SYSTEM CONFIGURATION screen.

*[2] These values are set on the PiCCO monitor.

*[3] When the blood pressure unit is kPa, this unit becomes kPa•s/L.

*[4] When the blood pressure unit is kPa, this unit becomes kPa•s•m^2/L.

*[5] These parameters are not available on BSM-6000A series.

*[6] These parameters are not available when the QF-911P interface version is 01-01.

Monitoring Parameters and Settings

The parameters and settings that can be displayed on the bedside monitor screen depend on the PiCCO monitor type and bedside monitor setting as shown below.

Yes: displayed No: not displayed

When the <NUMERIC DISPLAY> on the OTHER Page is Set to ABSOLUTE

Label	**PiCCO Monitor Type**			
	PiCCO *plus*	SP 7.0	V1.0	V3.0
PCCO	Yes	Yes	Yes	Yes
GEDV	Yes	Yes	Yes	Yes
ITBV	Yes	Yes	Yes	Yes
SVR	Yes	Yes	Yes	Yes
SV	Yes	Yes	Yes	Yes
CO	Yes	Yes	Yes	Yes
SVV	Yes	Yes	Yes	Yes
PPV	Yes	Yes	Yes	Yes
GEF*[1]	Yes	Yes	Yes	Yes
dPmax*[1]	Yes	Yes	Yes	Yes
CFI	Yes	Yes	Yes	Yes
EVLW	Yes	Yes	Yes	Yes
$ScvO_2$*[1]*[2]	No	No	Yes	Yes
SpO_2*[1]*[2]	No	No	No	Yes
PVPI*[1]	No	Yes	Yes	Yes
CPO*[1]*[2]	No	No	Yes	Yes
PDR*[1]*[2]	No	No	No	Yes
R15*[1]*[2]	No	No	No	Yes
DO_2*[1]*[2]	No	No	Yes	Yes
VO_2*[1]*[2]	No	No	Yes	Yes
Height	Yes	Yes	Yes	Yes
Weight	Yes	Yes	Yes	Yes

When the <NUMERIC DISPLAY> on the OTHER Page is Set to INDEX

Label	**PiCCO Monitor Type**			
	PiCCO *plus*	SP 7.0	V1.0	V3.0
PCCI	No	Yes	Yes	Yes
GEDVI	No	Yes	Yes	Yes
ITBVI	No	Yes	Yes	Yes
SVRI	No	Yes	Yes	Yes
SVI	No	Yes	Yes	Yes
CI	No	Yes	Yes	Yes
SVV	Yes	Yes	Yes	Yes
PPV	Yes	Yes	Yes	Yes
GEF*[1]	Yes	Yes	Yes	Yes
dPmax*[1]	Yes	Yes	Yes	Yes
CFI	Yes	Yes	Yes	Yes
EVLWI	No	Yes	Yes	Yes
$ScvO_2$*[1]*[2]	No	No	Yes	Yes
SpO_2*[1]*[2]	No	No	No	Yes
PVPI*[1]	No	Yes	Yes	Yes
CPI*[1]*[2]	No	No	Yes	Yes
PDR*[1]*[2]	No	No	No	Yes
R15*[1]*[2]	No	No	No	Yes
DO_2I*[1]*[2]	No	No	Yes	Yes
VO_2I*[1]*[2]	No	No	Yes	Yes
Height	Yes	Yes	Yes	Yes
Weight	Yes	Yes	Yes	Yes

*[1] These parameters are not available on BSM-6000A series.

*[2] These parameters are not available when the QF-911P interface version is 01-01.

Preparing for PiCCO Monitoring

1. Set up the PiCCO monitor and connect it to the bedside monitor. Refer to the QF-911P interface manual.

2. Connect the PiCCO monitor to the patient. Refer to the PiCCO monitor manual.

3. Start measurement and change necessary settings.

Monitoring PiCCO

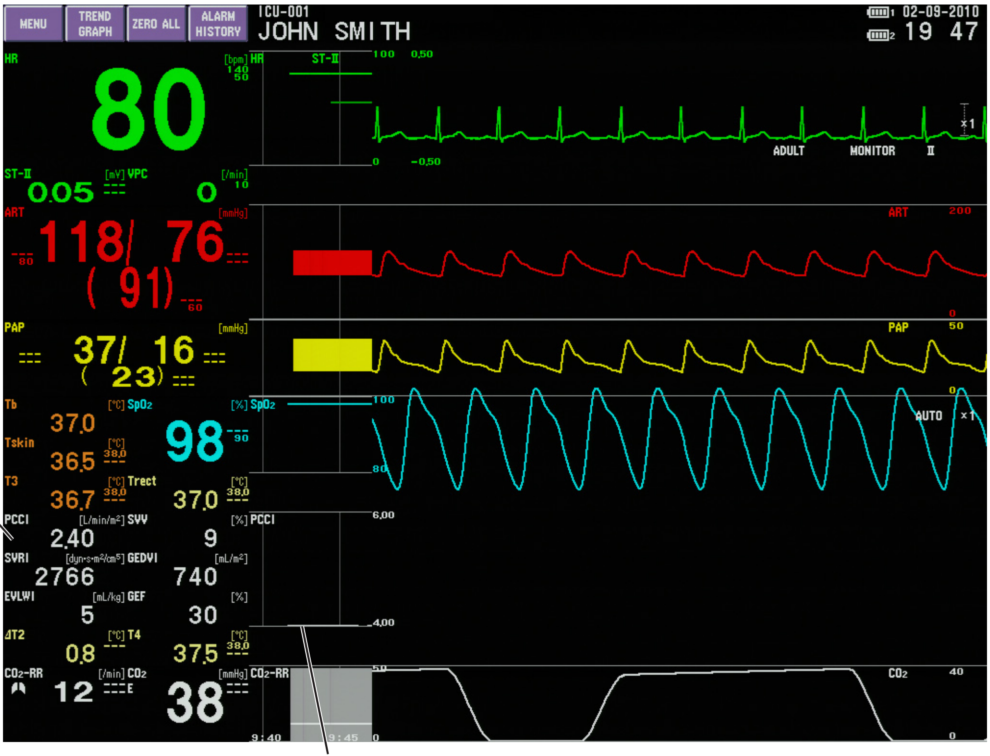
After completing the preparation, PiCCO data appear on the screen.

> **WARNING**
>
> The PiCCO alarms do not function on the bedside monitor. When the PiCCO data on the bedside monitor is abnormal, check the alarm on the PiCCO monitor.

PiCCO Information on the Home Screen

When the RS-232C setting on the PiCCO monitor is PiCCO *plus*:
BSM-6000A series: PCCO, SVV, SVR, GEDV, EVLW, Tb
BSM-6000K series: PCCO, SVV, SVR, GEDV, EVLW, GEF, Tb

When the RS-232C setting on PiCCO monitor version is SP 7.0/V1.0/V3.0:
BSM-6000A series: PCCO/PCCI, SVV, SVR/SVRI, GEDV/GEDVI, EVLW/EVLWI, Tb
BSM-6000K series: PCCO/PCCI, SVV, SVR/SVRI, GEDV/GEDVI, EVLW/EVLWI, GEF, Tb


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
02-09-2010
19 47
HR
80
ST-II
0.05
VPC
0
ART
118/ 76
(91)
PAP
37/ 16
(23)
Tb
37.0
SpO2
98
Tskin
36.5
T3
36.7
Trect
37.0
PCCI
2.40
SVV
9
SVRI
2766
GEDVI
740
EVLWI
5
GEF
30
ΔT2
0.8
T4
37.5
CO2-RR
12
CO2
38
ADULT
MONITOR
AUTO

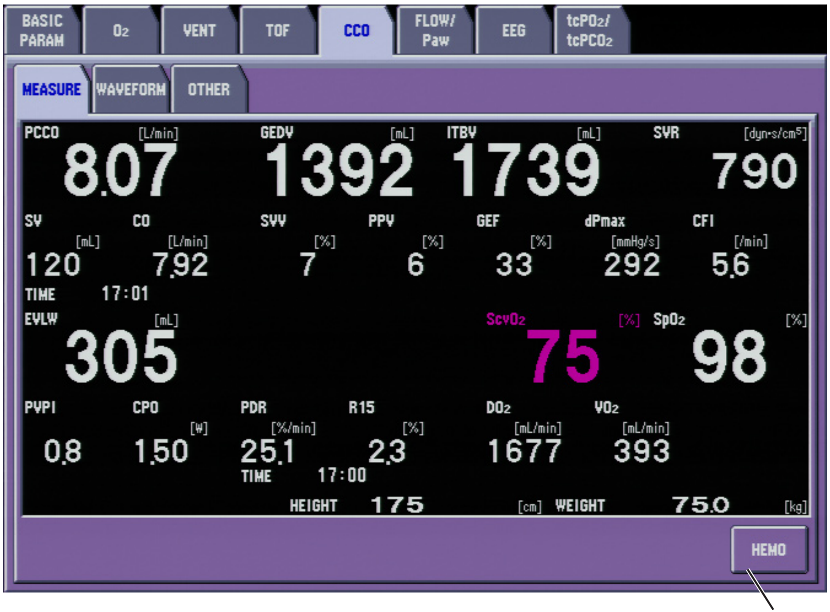
PCCO parameters
(Depend on the NUMERIC DISPLAY setting on the OTHER page)

PCCO or PCCI trendgraph
(Depends on the NUMERIC DISPLAY setting on the OTHER page)

PiCCO Information on the MEASURE page of CCO Window

Screen examples are when the RS-232C setting on PiCCO monitor version is V3.0.

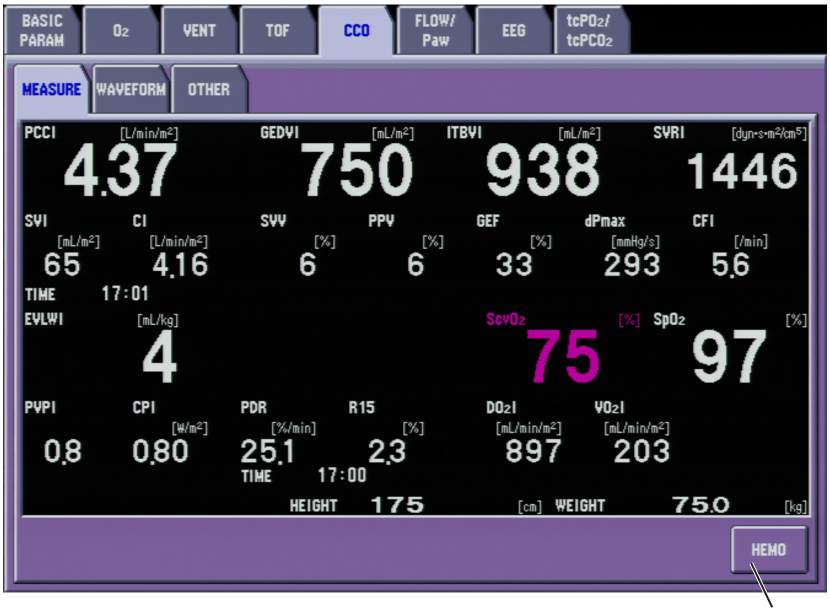
When the <NUMERIC DISPLAY> on the OTHER Page is Set to ABSOLUTE


BASIC PARAM
O$_2$
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO$_2$/ tcPCO$_2$
MEASURE
WAVEFORM
OTHER
HEMO

PCCO [L/min] 8.07
GEDV [mL] 1392
ITBV [mL] 1739
SVR [dyn·s/cm^5] 790
SV [mL] 120
CO [L/min] 7.92
SVV [%] 7
PPV [%] 6
GEF [%] 33
dPmax [mmHg/s] 292
CFI [/min] 5.6
TIME 17:01
EVLW [mL] 305
ScvO$_2$ [%] 75
SpO$_2$ [%] 98
PVPI 0.8
CPO [W] 1.50
PDR [%/min] 25.1
R15 [%] 2.3
TIME 17:00
DO$_2$ [mL/min] 1677
VO$_2$ [mL/min] 393
HEIGHT 175 [cm]
WEIGHT 75.0 [kg]

Displays the hemodynamics table on the HEMO Page of the TREND Window

When the <NUMERIC DISPLAY> on the OTHER Page is Set to INDEX


BASIC PARAM
O$_2$
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO$_2$/ tcPCO$_2$
MEASURE
WAVEFORM
OTHER
HEMO

PCCI [L/min/m^2] 4.37
GEDVI [mL/m^2] 750
ITBVI [mL/m^2] 938
SVRI [dyn·s·m^2/cm^5] 1446
SVI [mL/m^2] 65
CI [L/min/m^2] 4.16
SVV [%] 6
PPV [%] 6
GEF [%] 33
dPmax [mmHg/s] 293
CFI [/min] 5.6
TIME 17:01
EVLWI [mL/kg] 4
ScvO$_2$ [%] 75
SpO$_2$ [%] 97
PVPI 0.8
CPI [W/m^2] 0.80
PDR [%/min] 25.1
R15 [%] 2.3
TIME 17:00
DO$_2$I [mL/min/m^2] 897
VO$_2$I [mL/min/m^2] 203
HEIGHT 175 [cm]
WEIGHT 75.0 [kg]

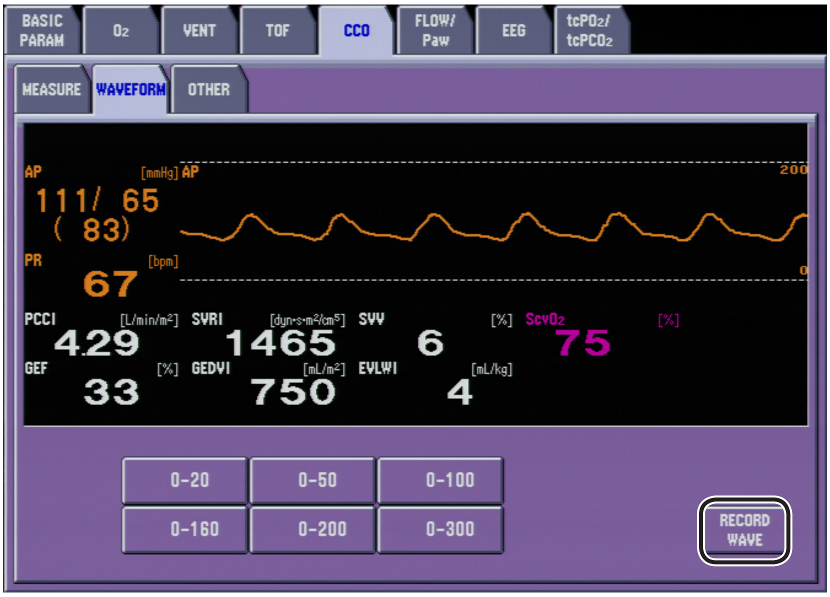
Displays the hemodynamics table on the HEMO Page of the TREND Window

Recording the PiCCO Data on the WAVEFORM Page of CCO Window

AP waveform and PiCCO data on the WAVEFORM page of the CCO window can be recorded.

1. Display the WAVEFORM page of the CCO window.
   Press [Menu] key → CCO key → WAVEFORM tab.

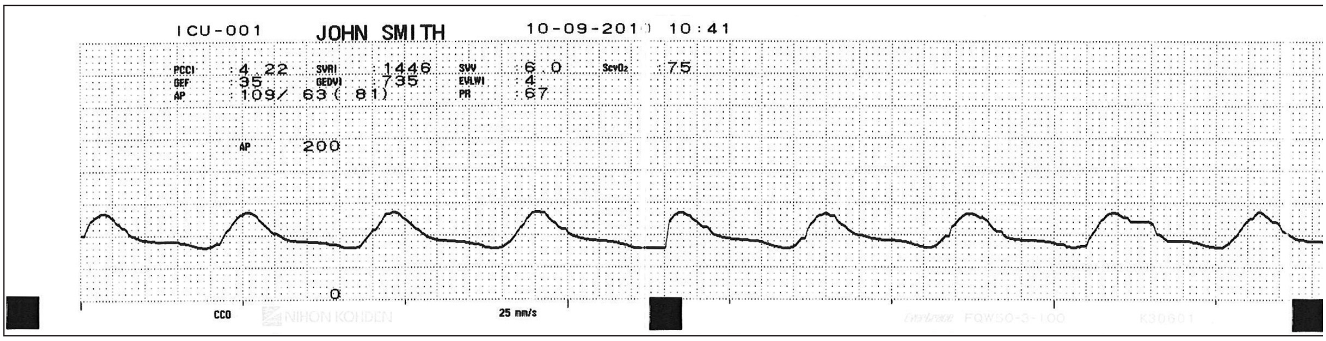
2. Touch the RECORD WAVE key. Recording starts.

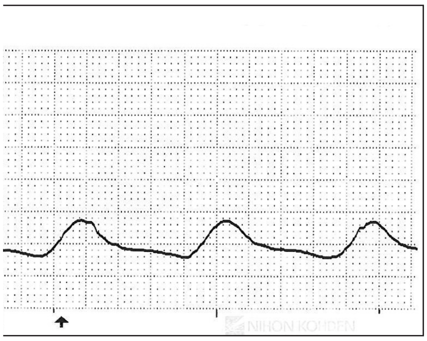

BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
WAVEFORM
OTHER
AP [mmHg]
111/ 65 (83)
AP
200
0
PR [bpm]
67
PCCI [L/min/m²] 4.29
SVRI [dyn·s·m²/cm⁵] 1465
SVV [%] 6
ScvO2 [%] 75
GEF [%] 33
GEDVI [mL/m²] 750
EVLWI [mL/kg] 4
0-20
0-50
0-100
0-160
0-200
0-300
RECORD WAVE

   To stop recording, press the [Record] key.

3. Press the [Home] key to return to the home screen.

Recording example





Hemodynamics Table on the HEMO Page of the TREND Window

When cardiac output is monitored by the PiCCO monitor, the CO data is listed on the HEMO page of the TREND window. When CO is monitored, CO and CI are also added to this list. For details on the HEMO page, refer to Section 6 of the User's Guide Part I.

Changing the PiCCO Setting

Change the settings on the CCO window. The following settings can be changed.

- Scale for AP waveform on the WAVEFORM page of the CCO window
- Absolute or index numeric display on the home screen and MEASURE page of the CCO window

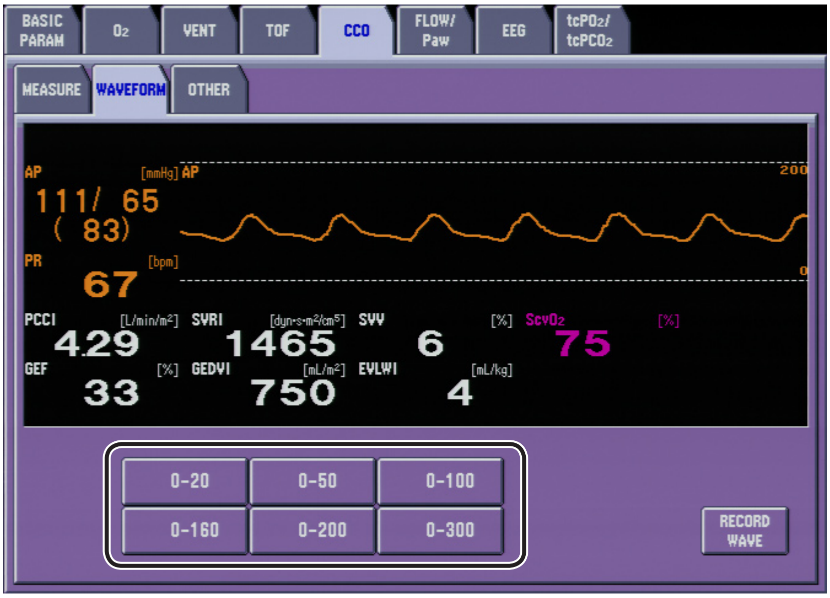
The display color for CCO can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Changing the Scale of the AP Waveform on the WAVEFORM Page CCO Window

The scale of the AP waveform on the CCO window can be changed.

1. Display the WAVEFORM page of the CCO window.
   Press [Menu] key → CCO key → WAVEFORM tab.

2. Select the scale by touching the desired scale key.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
WAVEFORM
OTHER
AP [mmHg] AP
200
111/ 65
(83)
PR [bpm]
67
0
PCCI [L/min/m²]
4.29
SVRI [dyn·s·m²/cm⁵]
1465
SVV [%]
6
ScvO2 [%]
75
GEF [%]
33
GEDVI [mL/m²]
750
EVLWI [mL/kg]
4
0-20
0-50
0-100
0-160
0-200
0-300
RECORD WAVE

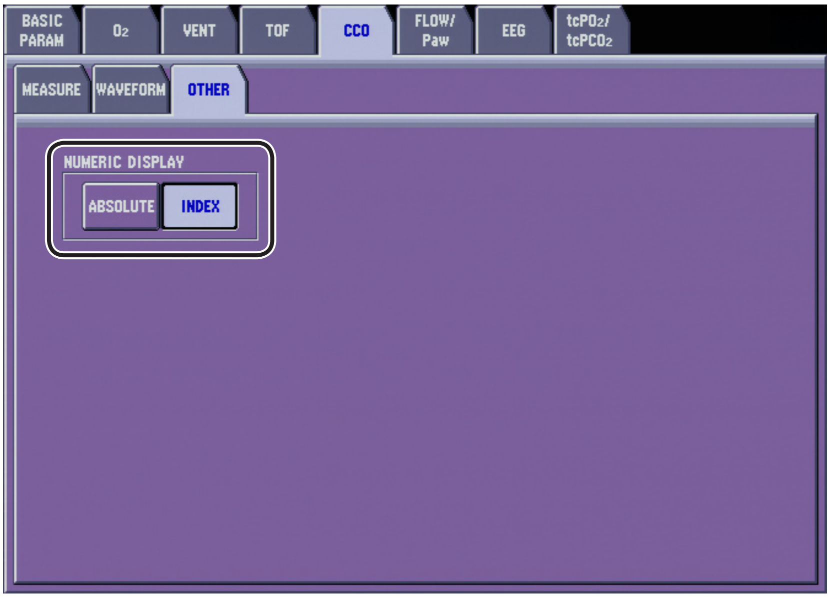
3. Press the [Home] key to return to the home screen.

Selecting the Absolute or Index Value to be Displayed

Either absolute or index value can be displayed on the home screen and MEASURE page of the CCO window.

1. Display the OTHER page of the CCO window.
   Press [Menu] key → CCO key → OTHER tab

2. Select either ABSOLUTE or INDEX in the <NUMERIC DISPLAY> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
WAVEFORM
OTHER
NUMERIC DISPLAY
ABSOLUTE
INDEX

3. Press the [Home] key to return to the home screen.

CCO/S$\bar{v}$O$_2$ Monitoring by SO$_2$/CCO Monitor

General

Oxygen saturation and continuous cardiac output monitoring can be performed by connecting a Hospira oxygen saturation and continuous cardiac output monitor, Q-VUE/Q2/Q2 plus computer (SO$_2$/CCO monitor) to the bedside monitor. To connect the SO$_2$/CCO monitor to the bedside monitor, the IF-922P communication cable is required.

WARNING

The alarm does not function on the bedside monitor when a SO$_2$/CCO monitor is connected. When the data is abnormal, check the alarm on the SO$_2$/CCO monitor.

NOTE

- If a SO$_2$/CCO monitor parameter is not monitored on the SO$_2$/CCO monitor, it is not displayed on the bedside monitor.
- Some SO$_2$/CCO monitor parameters cannot be displayed on the bedside monitor even if they are monitored on the SO$_2$/CCO monitor.

List of Terms

Label	Name	Unit
HR	Heart rate	beat/min
CCO	Continuous cardiac output	L/min
CCI*[1]	Continuous cardiac index	L/min/m^2
Tb*[3]	Blood temperature	°C or °F*[2]
S$\bar{v}$O$_2$*[3]	Oxygen saturation	%
ART	Arterial pressure	mmHg or kPa*[2]
CVP	Central venous pressure	mmHg or kPa*[2]
SV	Stroke volume	mL
SVR	Systemic vascular resistance	dyn·s/cm^5*[4]
SVRI*[1]	Systemic vascular resistance index	dyn•s•m^2/cm^5*[5]

*[1] Enter the height and weight on the PATIENT INFO page of the ADMIT window. Otherwise they cannot be displayed.

*[2] The temperature unit (°C or °F) and blood pressure unit (mmHg or kPa) can be set on the SYSTEM CONFIGURATION screen of the bedside monitor.

*[3] Replace the following parameters on the SO$_2$/CCO monitor.
Tb: BT, CO: ICO mean, S$\bar{v}$O$_2$: SO$_2$

*[4] When the blood pressure unit is kPa, this unit becomes kPa•s/L.

*[5] When the blood pressure unit is kPa, this unit becomes kPa•s•m^2/L.

Preparing for CCO/$S\bar{v}O_2$ Monitoring

1. Set up the SO_2/CCO monitor and connect it to the bedside monitor. Refer to the IF-922P communication cable manual.

2. Connect the SO_2/CCO monitor to the patient. Refer to the SO_2/CCO monitor manual.

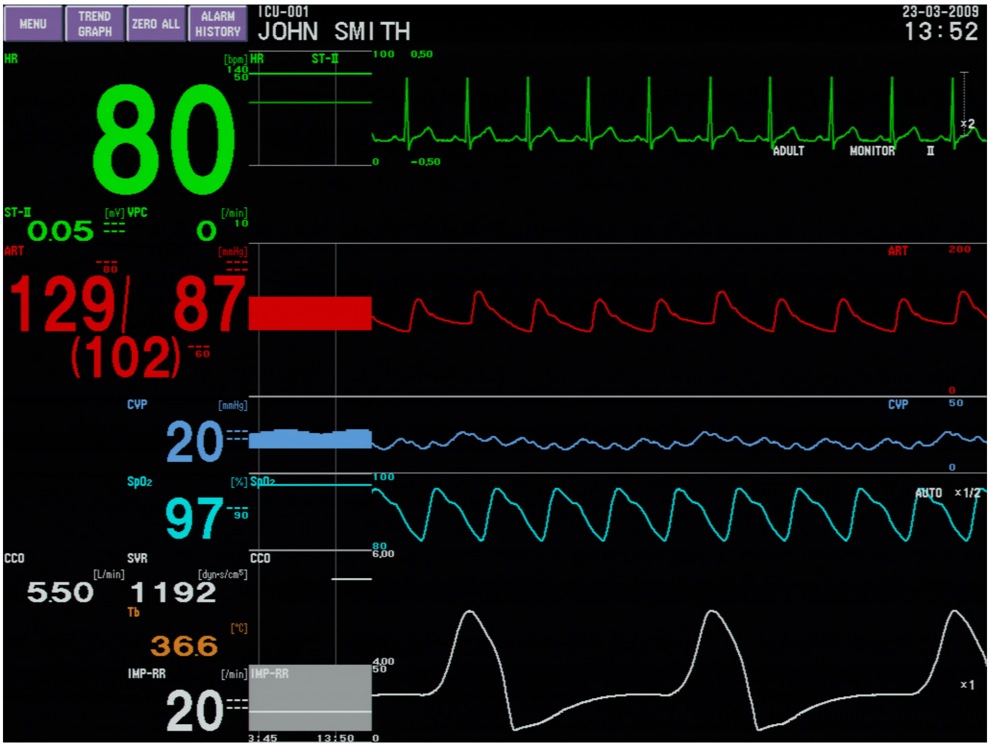
3. Start measurement and change necessary settings.

Monitoring CCO/$S\bar{v}O_2$

After completing the preparation, CCO/$S\bar{v}O_2$ data appear on the screen.

CCO Information on the Home Screen

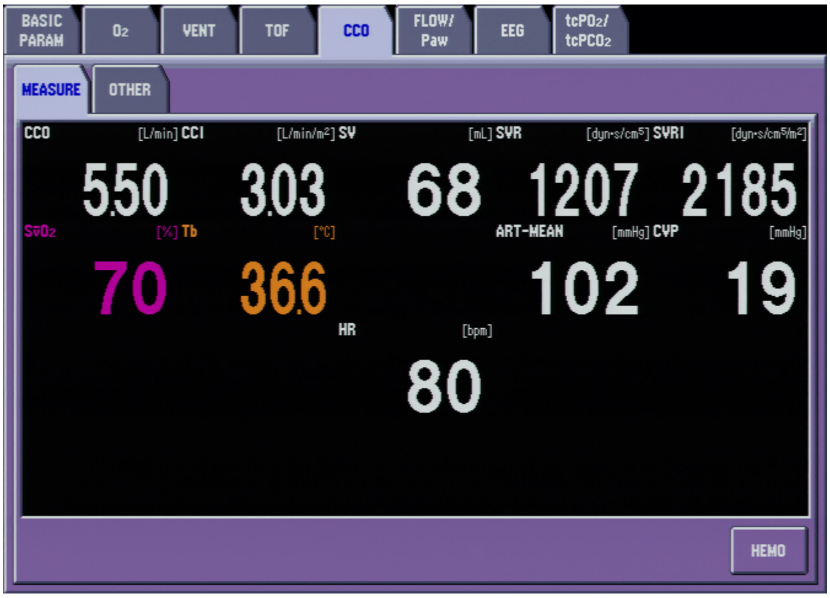
CCO: Data monitored on the SO_2/CCO monitor.


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
23-03-2009
13:52
HR
[bpm]
140
50
80
ST-II
0.05
[mV]
VPC
0
[/min]
10
100
0.50
0
-0.50
x2
ADULT
MONITOR
II
ART
[mmHg]
80
129/ 87
(102)
60
200
0
CVP
[mmHg]
20
50
SpO2
[%]
97
90
100
80
AUTO
x1/2
CCO
[L/min]
5.50
SVR
[dyn·s/cm⁵]
1192
Tb
[°C]
36.6
6.00
4.00
IMP-RR
[/min]
20
50
0
x1
3:45
13:50

When you are connecting a ventilator to the bedside monitor, only CCO is displayed.

CCO/$S\bar{v}O_2$ Information on the CCO Window

CCO, $S\bar{v}O_2$, Tb: Data monitored on the SO_2/CCO monitor.
HR, ART-MEAN, CVP: Data monitored on the bedside monitor.
CCI, SVR, SVRI, SV: Calculated from the data monitored on the SO_2/CCO monitor and bedside monitor.



CCO [L/min] 5.50
CCI [L/min/m²] 3.03
SV [mL] 68
SVR [dyn·s/cm⁵] 1207
SVRI [dyn·s/cm⁵/m²] 2185
$S\bar{v}O_2$ [%] 70
Tb [°C] 36.6
ART-MEAN [mmHg] 102
CVP [mmHg] 19
HR [bpm] 80

Opening the CCO Window

To open the CCO window:
Press [Menu] key → CCO key → MEASURE tab.

Hemodynamics Table on the HEMO Page of the TREND Window

When cardiac output is monitored by the SO_2/CCO monitor, the CO data is listed on the HEMO page of the TREND window. When CO is monitored, the CO and CI are also added to this list. For details on the HEMO page, refer to Section 6 of the User's Guide Part I.

CO: Data monitored on the SO_2/CCO monitor.
CI: Calculated from the data monitored on the SO_2/CCO monitor and bedside monitor.

The CCO parameters: CCO, CCI, $S\bar{v}O_2$, SVR, SVRI are listed on the TABLE page of the TREND window.
The CCO parameters: CCO, CCI, $S\bar{v}O_2$, SVRI are listed on the GRAPH page of the TREND window.

Changing the CCO/$S\bar{v}O_2$ Settings

Displaying CCO parameters on the home screen can be set on the CCO window.

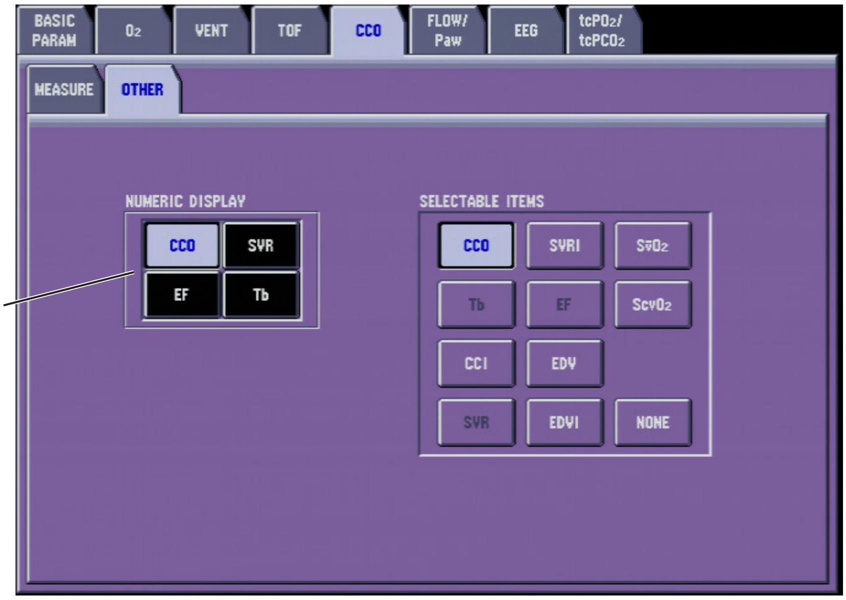
The display color for CCO can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Selecting the CCO/$S\bar{v}O_2$ Parameters to be Displayed on the Home Screen

1. Display the OTHER page of the CCO window.
   Press [Menu] key → CCO key → OTHER tab

2. Select the area for the parameter to be displayed on the home screen in the <NUMERIC DISPLAY> box.

3. Select the parameter to be displayed in the selected area from the <SELECTABLE ITEMS> box.


BASIC PARAM
O_2
VENT
TOF
CCO
FLOW/ Paw
EEG
$tcPO_2$/ $tcPCO_2$
MEASURE
OTHER
NUMERIC DISPLAY
CCO
SVR
EF
Tb
SELECTABLE ITEMS
CCO
SVRI
$S\bar{v}O_2$
Tb
EF
$ScvO_2$
CCI
EDV
SVR
EDVI
NONE

Displaying order on the home screen

4. Press the [Home] key to return to the home screen.

Explanation of Hemodynamics Data

Label	Name	Unit	Explanation and Equation
HR	Heart rate	bpm	Heart rate at the time the CO is measured.
CO	Cardiac output	L/min	—
CI	Cardiac index	L/min/m^2	CI = CO/BSA*1
CCO	Continuous cardiac output	L/min	—
CCI	Continuous cardiac output index	L/min/m^2	CCI = CCO/BSA*1
PCCO	Pulse contour cardiac output	L/min	—
PCCI	Pulse contour cardiac output index	L/min/m^2	—
ART-MEAN	Arterial mean pressure	mmHg*2	Values registered at the time the CO is measured.
PAP MEAN	Pulmonary arterial mean pressure		
PCWP	Pulmonary capillary wedge pressure		
PCWP TIME	Time PCWP is measured	hr:min	
CVP	Central venous mean pressure	mmHg*2	
SV	Stroke volume	mL	SV = (CO × 1000)/HR
SVI	Stroke volume index	mL/m^2	SVI = (CI × 1000)/HR
SVR	Systemic vascular resistance	dyn•s/cm^5*3	SVR = {(AP M – CVP M) × 80}/CO
SVRI	Systemic vascular resistance index	dyn•s•m^2/cm^5*4	SVRI = {(AP M – CVP M) × 80}/CI
SVV	Stroke volume variation	%	—
PPV	Pulse pressure variation	%	—
PVR	Pulmonary vascular resistance	dyn•s/cm^5*3	PVR = {(PAP M – PCWP) × 80}/CO
PVRI	Pulmonary vascular resistance index	dyn•s•m^2/cm^5*4	PVRI = {(PAP M – PCWP) × 80}/CI
LVSW	Left ventricular stroke work	g•m	LVSW = {SV × (AP M – PCWP)} × 0.0136
LVSWI	Left ventricular stroke work index	g•m/m^2	LVSWI = {SVI × (AP M – PCWP)} × 0.0136
RVSW	Right ventricular stroke work	g•m	RVSW = {SV × (PAP M – CVP M)} × 0.0136
RVSWI	Right ventricular stroke work index	g•m/m^2	RVSWI = {SVI × (PAP M – CVP M)} × 0.0136
EDV	End diastolic volume	mL	—
EDVI	End diastolic volume index	mL/m^2	EDVI = EDV/BSA*1
GEDV	Global end-diastolic volume	mL	—
GEDVI	Global end-diastolic volume index	mL/m^2	—
ESV	End systolic volume	mL	—
ESVI	End systolic volume index	mL/m^2	ESVI = ESV/BSA*1
EF	Ejection fraction	%	—
GEF	Global ejection fraction	%	—
ITBV	Intrathoracic blood volume	mL	—
ITBVI	Intrathoracic blood volume index	mL/m^2	—
EVLW	Extravascular lung water	mL	—
EVLWI	Extravascular lung water index	mL/kg	—
CFI	Cardiac function index	/min	—
PVPI	Pulmonary vascular permeability index	—	—
dPmax	Left ventricular contractility index	mmHg*2/s	—

[1] BSA = 0.007184 × $\text{Weight}^{0.425}$ × $\text{Height}^{0.725}$ (m^2) (DuBois equation)

[2] The blood pressure unit can be changed to kPa on the can be changed on the SYSTEM CONFIGURATION screen of the bedside monitor.

[3] When the blood pressure unit is kPa, this unit becomes kPa•s/L.

[4] When the blood pressure unit is kPa, this unit becomes kPa•s•m^2/L.

Section 15 FLOW/Paw Monitoring

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Monitoring FLOW/Paw 15.4
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    FLOW/Paw Information on the FLOW/Paw Window 15.5
Changing FLOW/Paw Settings 15.6
    Changing the MV, Ppeak, PEEP, Respiration Rate and Apnea Alarm Limits 15.6
    Changing the Scale 15.8
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Viewing the Loops 15.12
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NOTE

FLOW/Paw monitoring is not available for BSM-6000A series.

General

To monitor overall respiratory condition of a patient, use the GF-120PA or GF-220R multigas/flow unit.

NOTE

When using a Dräger Medical Primus/Fabius® anesthesia workstation, the following external instruments cannot be used.

- AG-920R multigas unit
- GF-110PA/GF-210R multigas unit
- GF-120PA/GF-220R multigas/flow unit
- Ventilator

List of Terms

Terms	Meaning	Unit
FLOW	Respiratory flow rate	L/s
Paw	Airway pressure	cmH_2O or hPa*
VOL	Respiratory volume	mL
Ppeak	Peak airway pressure	cmH_2O or hPa*
PEEP	Positive end expiratory pressure	cmH_2O or hPa*
Pmean	Mean airway pressure	cmH_2O or hPa*
FLOW-RR	Respiration rate from flow waveform	Counts/min
MV	Minute volume	L/min
TVe	Expiratory tidal volume	mL
TVi	Inspiratory tidal volume	mL
C	Compliance	mL/cmH_2O or hPa*
R	Airway resistance	cmH_2O or hPa*/L/s
Re	Expiratory airway resistance	cmH_2O or hPa*/L/s
Ri	Inspiratory airway resistance	cmH_2O or hPa*/L/s
I:E	Inspiration expiration ratio	–

* The respiration unit (cmH_2O or hPa) can be set on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator’s Guide.

Preparing for FLOW/Paw Monitoring

Preparation Flowchart

1. Set up the GF-120PA or GF-220R multigas/flow unit and connect the multi-link cable of the unit to the bedside monitor.

2. Connect the flow adapter to the respiration circuit of the patient.

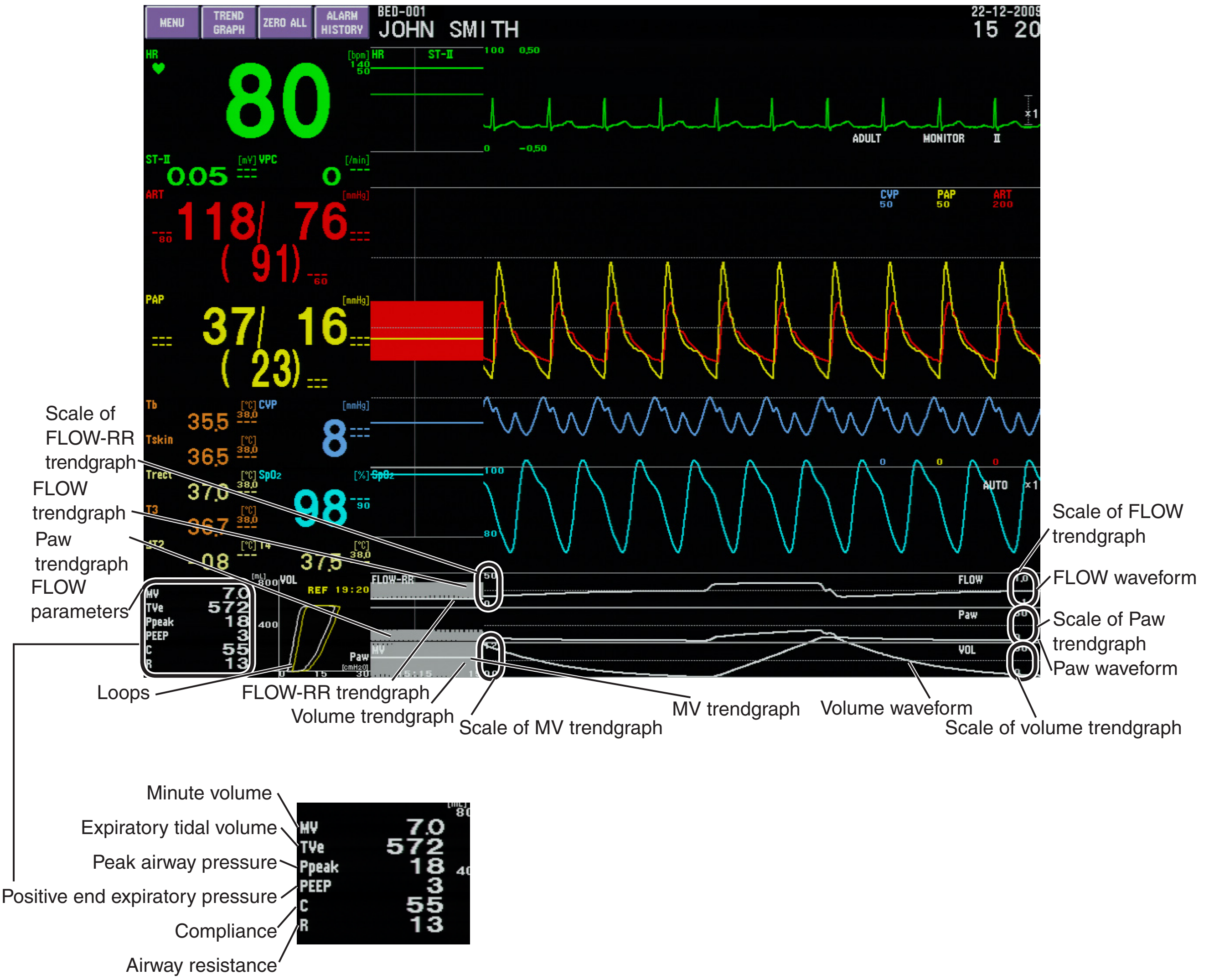
3. Start measurement and change necessary settings.

For steps 1 and 2, refer to the GF-120PA or GF-220R multigas/flow unit operator’s manual.

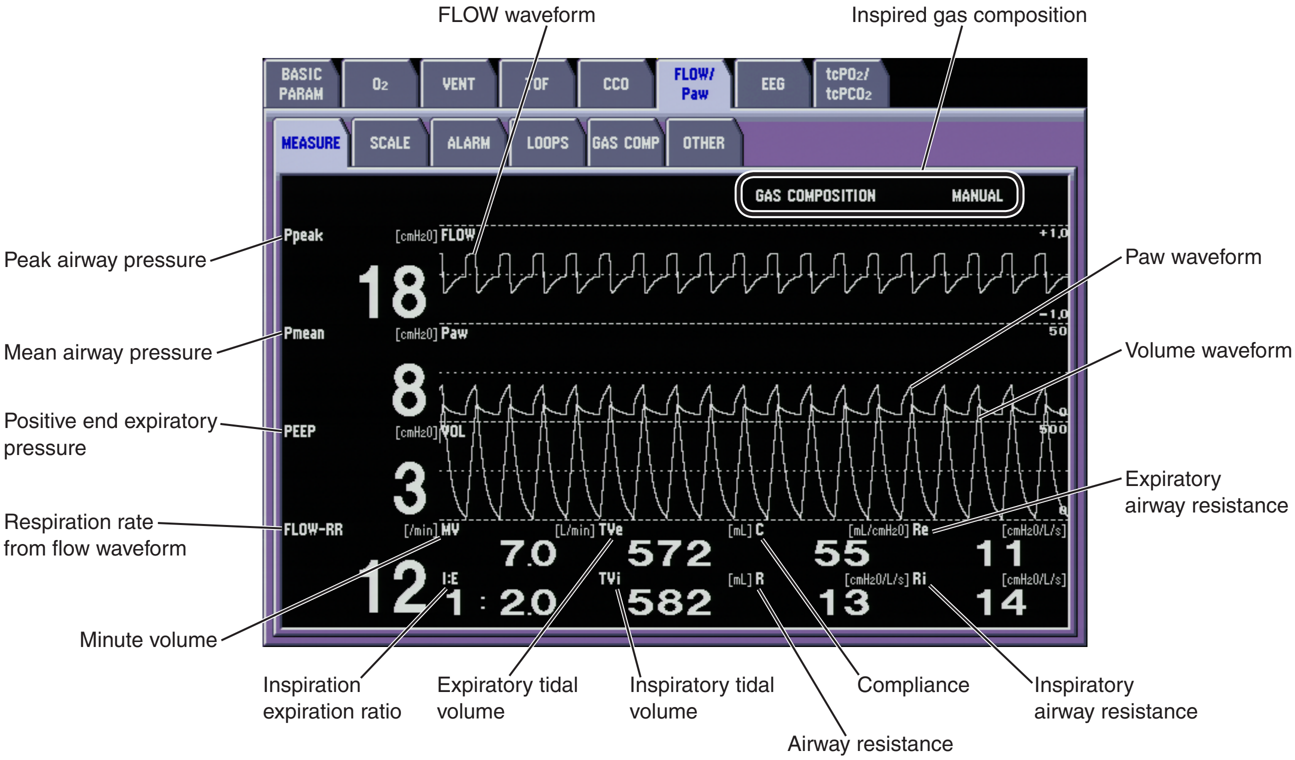
Monitoring FLOW/Paw

After completing the preparation, FLOW/Paw data and waveforms appear on the screen.

FLOW/Paw Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
BED-001
JOHN SMITH
22-12-2005
15 20
HR 80
ST-II 0.05
VPC 0
ART 118/ 76 (91)
PAP 37/ 16 (23)
Tb 35.5
Tskin 36.5
Trect 37.0
T3 36.7
CVP 8
SpO2 98
FLOW
Paw
VOL
MV 7.0
TVe 572
Ppeak 18
PEEP 3
C 55
R 13
Scale of FLOW-RR trendgraph
FLOW trendgraph
Paw trendgraph
FLOW parameters
Loops
FLOW-RR trendgraph
Volume trendgraph
Scale of MV trendgraph
MV trendgraph
Volume waveform
Scale of volume trendgraph
Scale of FLOW trendgraph
FLOW waveform
Scale of Paw trendgraph
Paw waveform
Minute volume
Expiratory tidal volume
Peak airway pressure
Positive end expiratory pressure
Compliance
Airway resistance

FLOW/Paw Information on the FLOW/Paw Window


FLOW waveform
Inspired gas composition
BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
GAS COMPOSITION MANUAL
Peak airway pressure
Ppeak 18
[cmH2O] FLOW
+1.0
-1.0
Mean airway pressure
Pmean 8
[cmH2O] Paw
50
0
Positive end expiratory pressure
PEEP 3
[cmH2O] VOL
500
0
Respiration rate from flow waveform
FLOW-RR 12
[/min] MV 7.0
[L/min] TVe 572
[mL] C 55
[mL/cmH2O] Re 11
[cmH2O/L/s]
I:E 1 : 2.0
TVi 582
[mL] R 13
[cmH2O/L/s] Ri 14
[cmH2O/L/s]
Paw waveform
Volume waveform
Expiratory airway resistance
Minute volume
Inspiration expiration ratio
Expiratory tidal volume
Inspiratory tidal volume
Compliance
Inspiratory airway resistance
Airway resistance

Changing FLOW/Paw Settings

Change the settings on the FLOW/Paw window. The following settings can be changed for FLOW/Paw monitoring.

- MV, Ppeak, PEEP, respiration rate and apnea alarm settings
- Scale for FLOW, Paw and volume waveforms
- Various settings for loops (scale, reference loop, number of loops)
- Inspiration gas composition, temperature and humidity
- Displaying FLOW/Paw parameters on the home screen
- FLOW and Paw measurement on or off

The respiration unit (cmH_2O or hPa) can be set on the SYSTEM CONFIGURATION screen. Refer to Section 2 of the Administrator’s Guide.

The FLOW and Paw display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

The waveform display of the FLOW, Paw and MV on the home screen can be selected on the DISPLAY window. Refer to Section 3 of the User’s Guide Part I.

Changing the MV, Ppeak, PEEP, Respiration Rate and Apnea Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower MV, Ppeak, PEEP, respiration rate and apnea alarm limits on the FLOW/Paw window. You can set all alarms, including the upper and lower MV, Ppeak, PEEP, respiration rate and apnea alarm limits on the ALARM LIMITS window (See Operator’s Manual or Section 5 of the User’s Guide Part I). You can also set upper and lower respiration rate and apnea alarm limits on the RESP, CO_2, and GAS windows.

Setting Range

MV upper limit: 0.1 to 30.0 L/min in 0.1 L/min steps, OFF (default setting: OR/ICU-10.0 L/min, NICU-OFF)
MV lower limit: OFF, 0.0 to 29.9 L/min in 0.1 L/min steps (default setting: OR/ICU-2.0 L/min, NICU-OFF)
Ppeak upper limit: 1 to 100 cmH_2O in 1 cmH_2O steps (1 to 100 hPa in 1 hPa steps), OFF (default setting: OR/ICU-40 cmH_2O (40 hPa), NICU-OFF)
Ppeak lower limit: OFF, 0 to 99 cmH_2O in 1 cmH_2O steps (0 to 99 hPa in 1 hPa steps) (default setting: OFF)

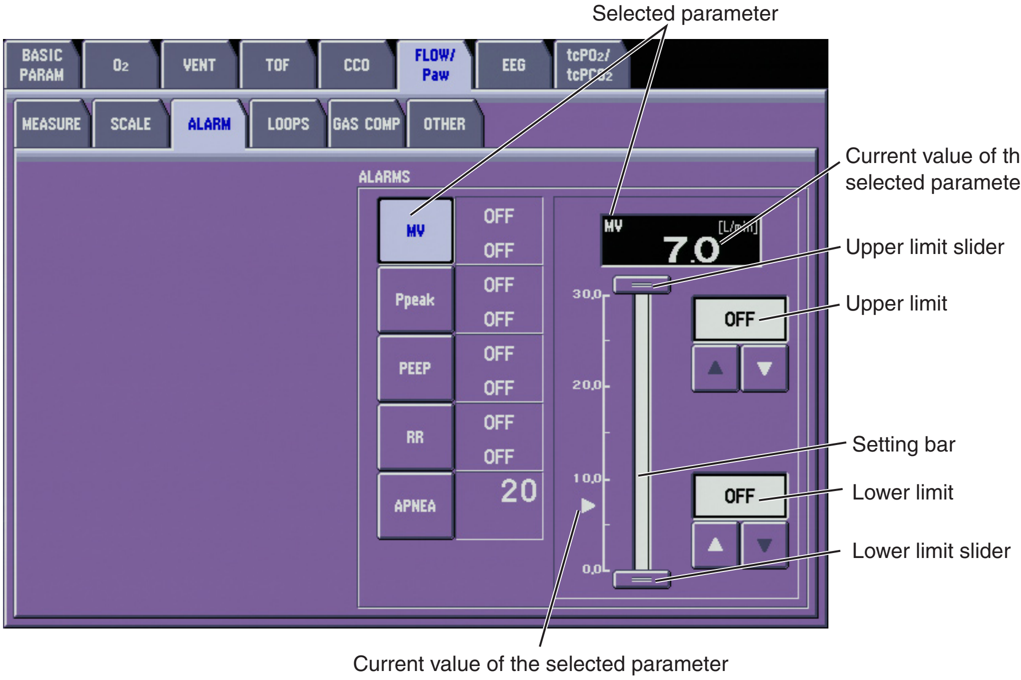
PEEP upper limit: 1 to 50 cmH_2O in 1 cmH_2O steps (1 to 50 hPa in 1 hPa steps), OFF (default setting: OR/ICU-10 cmH_2O (10 hPa), NICU-OFF)
PEEP lower limit: OFF, 0 to 49 cmH_2O in 1 cmH_2O steps (0 to 49 hPa in 1 hPa steps) (default setting: OFF)
Respiration rate upper limit: 2 to 150 counts/min in 2 counts/min steps, OFF (default setting: OFF)
Respiration rate lower limit: OFF, 0 to 148 counts/min in 2 counts/min steps (default setting: OFF)
Apnea upper limit: 5 to 40 s in 5 s steps, OFF (default setting: 20)

1. Display the ALARM page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → ALARM tab.

2. Touch the MV key to change the MV alarm setting.
   Touch the Ppeak key to change the Ppeak alarm setting.
   Touch the PEEP key to change the PEEP alarm setting.
   Touch the RR key to change the respiration rate alarm setting.
   Touch the APNEA key to change the apnea alarm setting.

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.


Selected parameter
BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
ALARMS
MV
OFF
OFF
Ppeak
OFF
OFF
PEEP
OFF
OFF
RR
OFF
OFF
APNEA
20
MV
[L/min]
7.0
30.0
20.0
10.0
0.0
OFF
▲
▼
OFF
▲
▼
Current value of the selected parameter
Upper limit slider
Upper limit
Setting bar
Lower limit
Lower limit slider
Current value of the selected parameter

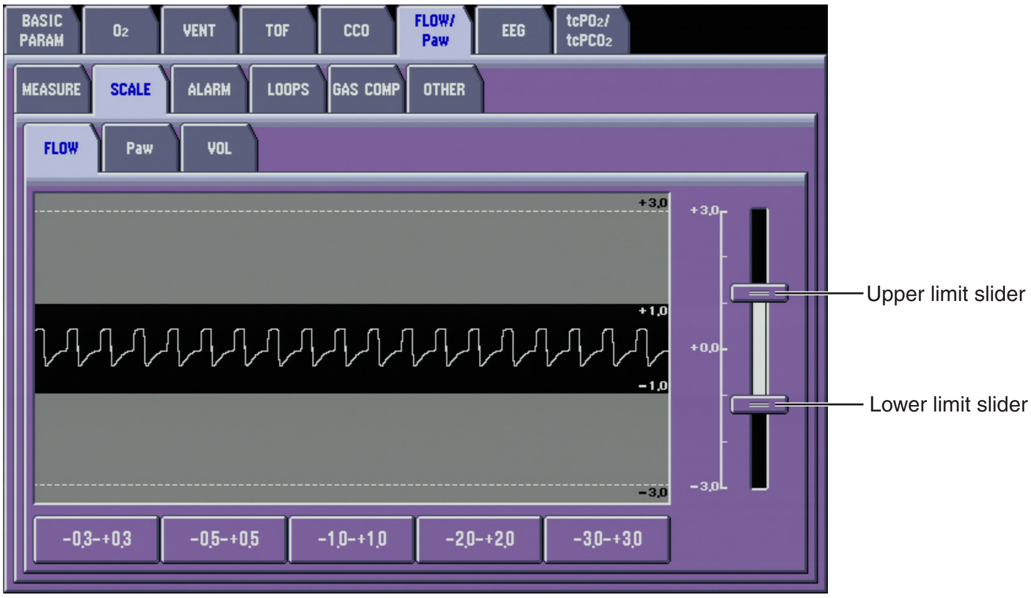
4. Press the [Home] key to return to the home screen.

Changing the Scale

The scale can be changed for the FLOW, Paw and volume waveforms. The same scale is used on both the home screen and FLOW/Paw window.

1. Display the SCALE page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → SCALE tab.

2. Select the appropriate scale for each parameter. Touch and drag the sliders to the desired level on the setting bar.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
FLOW
Paw
VOL
+3.0
+1.0
-1.0
-3.0
+3.0
+0.0
-3.0
Upper limit slider
Lower limit slider
-0.3-+0.3
-0.5-+0.5
-1.0-+1.0
-2.0-+2.0
-3.0-+3.0

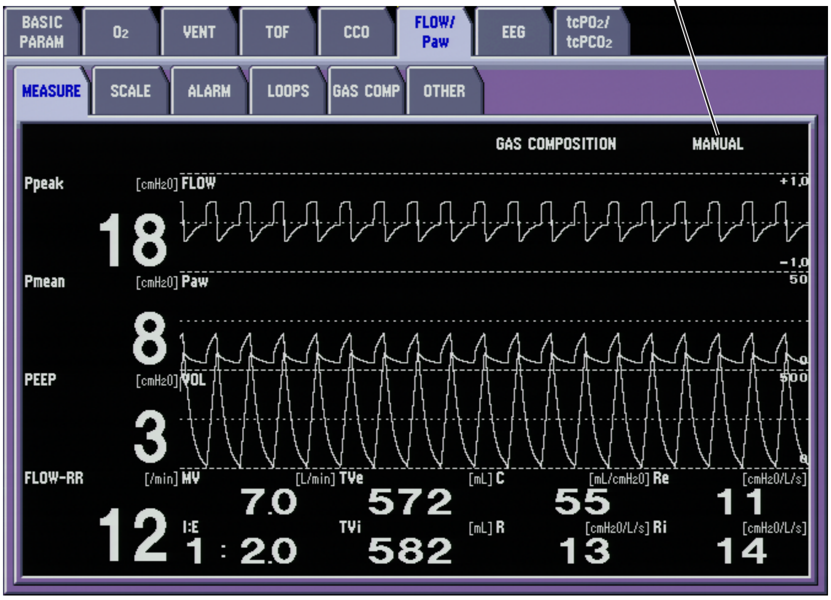
3. Press the [Home] key to return to the home screen.

Setting the Inspired Gas Composition

The measured FLOW values are affected by the gas composition due to the measurement principle of the FLOW sensor.

When the GF-120PA or GF-220R multigas/flow unit is used, the gas composition is automatically set. If “MANUAL” is displayed for the gas composition, it means that the gas is not monitored properly by the multigas unit. Check the settings, connection and monitoring condition of the multigas unit.

When another gas monitor or ventilator is used or when <GAS MEASUREMENT> on the OTHER page of the GAS window is set to OFF, set the gas composition manually.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
[cmH2O] FLOW
+1.0
-1.0
[cmH2O] Paw
50
0
[cmH2O] VOL
500
0

Manual gas composition

GAS COMPOSITION MANUAL

Ppeak 18

Pmean 8

PEEP 3

FLOW-RR 12

[/min] MV 7.0

I:E 1 : 2.0

[L/min] TVe 572

TVi 582

[mL] C 55

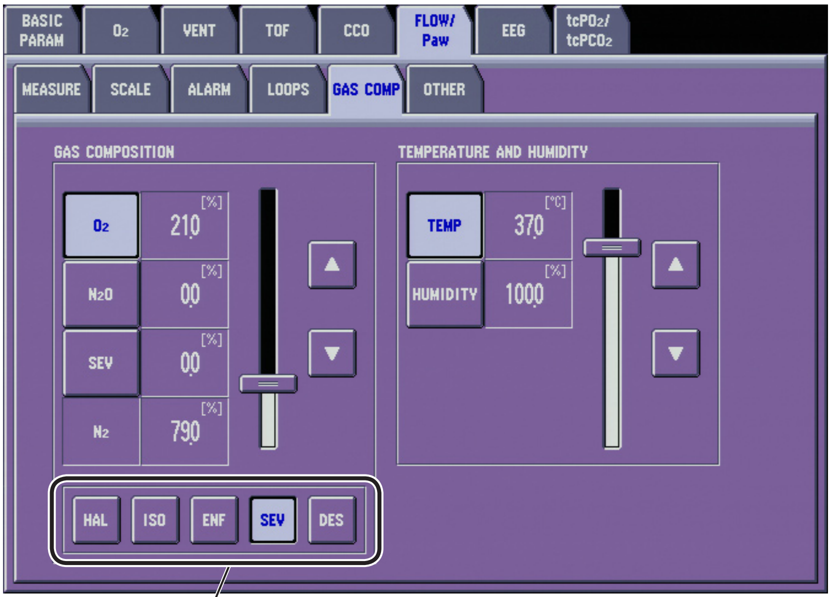
[mL] R 13

[mL/cmH2O] Re 11

[cmH2O/L/s] Ri 14

1. Display the GAS COMP page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → GAS COMP tab.

2. Touch the O_2 key to set the oxygen percentage.
   Touch the N_2O key to set the N_2O anesthetic gas percentage.
   Touch the agent key to set the agent percentage when using a volatile anesthetic gas. You can select the type of agent from the five keys at the bottom of the page.
   The N_2 percentage is automatically calculated from the equation below.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
▲
▼
▲
▼
HAL
ISO
ENF
SEV
DES

GAS COMPOSITION

O2 21.0 [%]

N2O 0.0 [%]

SEV 0.0 [%]

N2 79.0 [%]

TEMPERATURE AND HUMIDITY

TEMP 37.0 [°C]

HUMIDITY 100.0 [%]

Select the anesthetic gas

Setting Range

O_2: 0 to 100% in 0.1 steps (default setting: 21%)

N_2O: 0 to 100% in 0.1 steps 0 to 100% in 0.1 steps (default setting: 0%)

AGENT: 0 to 100% in 0.1 steps (default setting: 0%)

N_2*: 0 to 100% in 0.1 steps

* N_2 (%) = 100 – O_2 – N_2O – agent

3. Set the appropriate percentage. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

4. Press the [Home] key to return to the home screen.

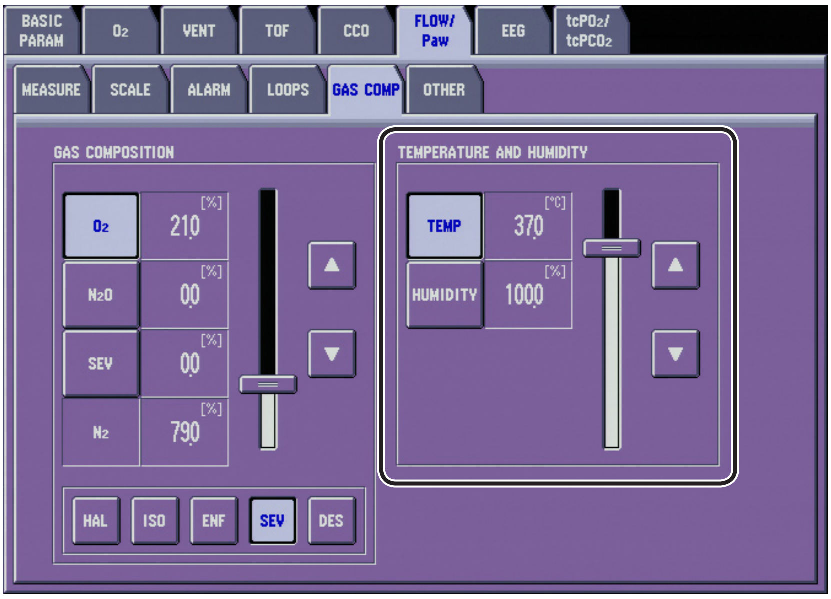
Setting the Temperature and Humidity of the Inspired Gas

When FLOW and Paw are measured at the patient’s mouth, usually there is no need to set the temperature and humidity of the inspired gas because FLOW is measured at 37°C (98.6°F) temperature and 100% humidity.

To use the FLOW sensor at high precision, change the temperature and humidity of the gas to be measured.

1. Display the GAS COMP page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → GAS COMP tab.

2. Touch the TEMP key to set the temperature of the gas.
   Touch the HUMIDITY key to set the humidity of the gas.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
GAS COMPOSITION
HAL
ISO
ENF
SEV
DES
TEMPERATURE AND HUMIDITY
▲
▼

O2 [%] 21.0
N2O [%] 0.0
SEV [%] 0.0
N2 [%] 79.0
TEMP [°C] 37.0
HUMIDITY [%] 100.0

3. Set the temperature and humidity of the gas. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

4. Press the [Home] key to return to the home screen.

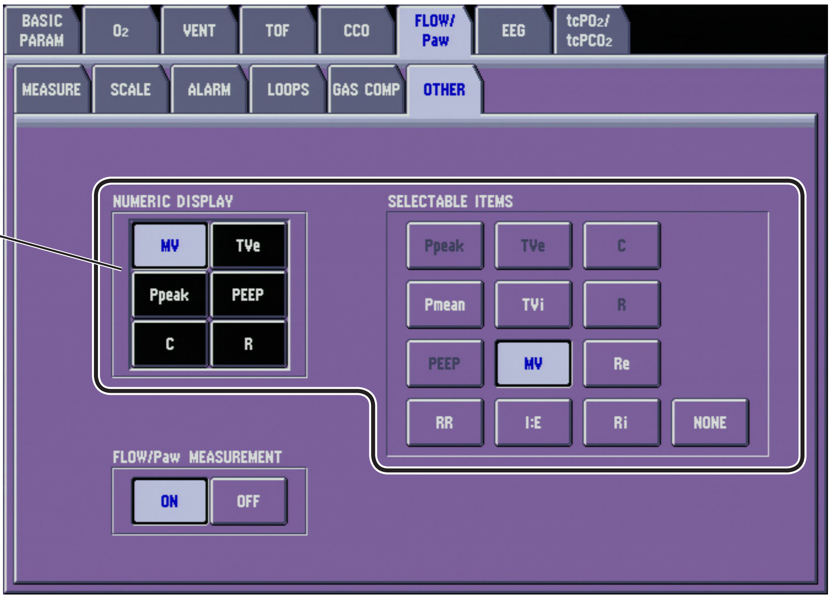
Selecting the FLOW/Paw Parameters to be Displayed on the Home Screen

Up to 6 FLOW/Paw parameters can be displayed on the home screen.

1. Display the OTHER page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → OTHER tab.

2. Select the area on the home screen where the parameter is to be displayed in the <NUMERIC DISPLAY> box.

3. Select the parameter to be displayed from the <SELECTABLE ITEMS> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
NUMERIC DISPLAY
MV
TVe
Ppeak
PEEP
C
R
SELECTABLE ITEMS
Ppeak
TVe
C
Pmean
TVi
R
PEEP
MV
Re
RR
I:E
Ri
NONE
FLOW/Paw MEASUREMENT
ON
OFF

Displaying area on the home screen

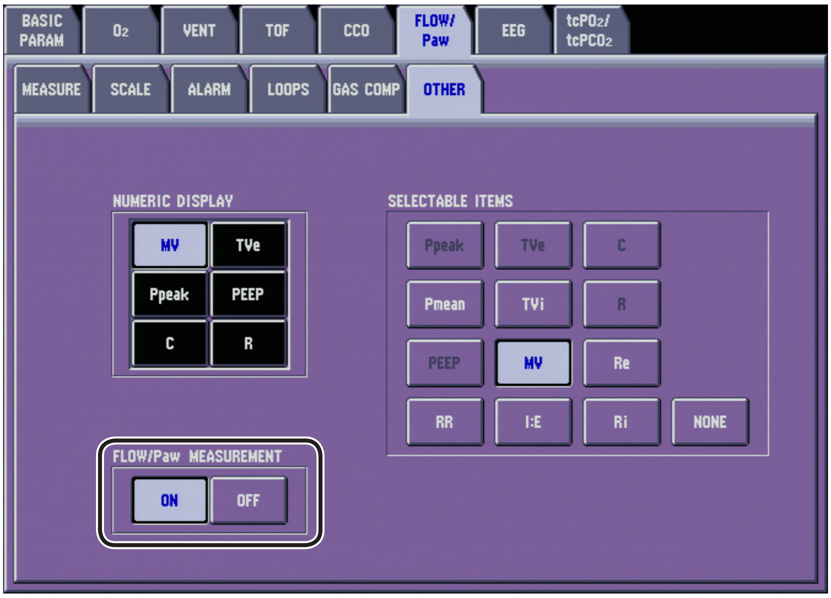
4. Press the [Home] key to return to the home screen.

Turning FLOW/Paw Measurement On or Off

FLOW/Paw measurement can be turned off.

1. Display the OTHER page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → OTHER tab.

2. Select ON or OFF in the <FLOW/Paw MEASUREMENT> box to turn FLOW/Paw measurement on or off.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
NUMERIC DISPLAY
MV
TVe
Ppeak
PEEP
C
R
SELECTABLE ITEMS
Ppeak
TVe
C
Pmean
TVi
R
PEEP
MV
Re
RR
I:E
Ri
NONE
FLOW/Paw MEASUREMENT
ON
OFF

3. Press the [Home] key to return to the home screen.

Viewing the Loops

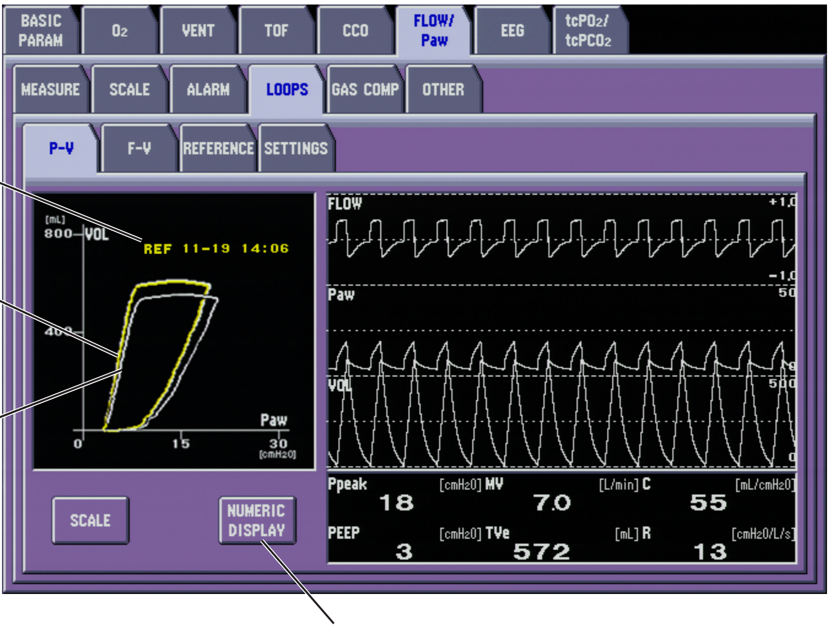
There are P-V loops and F-V loops for FLOW/Paw monitoring.

Displaying the Loop Window

There are separate windows for P-V loops and F-V loops.

1. Display the loop window for the desired loop type.

   P-V loop: Press [Home] key → FLOW/Paw key → LOOPS tab → P-V tab.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
Paw
0
15
30
[cmH2O]
FLOW
Paw
VOL
Ppeak
18
[cmH2O] MV
7.0
[L/min] C
55
[mL/cmH2O]
PEEP
3
[cmH2O] TVe
572
[mL] R
13
[cmH2O/L/s]
SCALE
NUMERIC DISPLAY

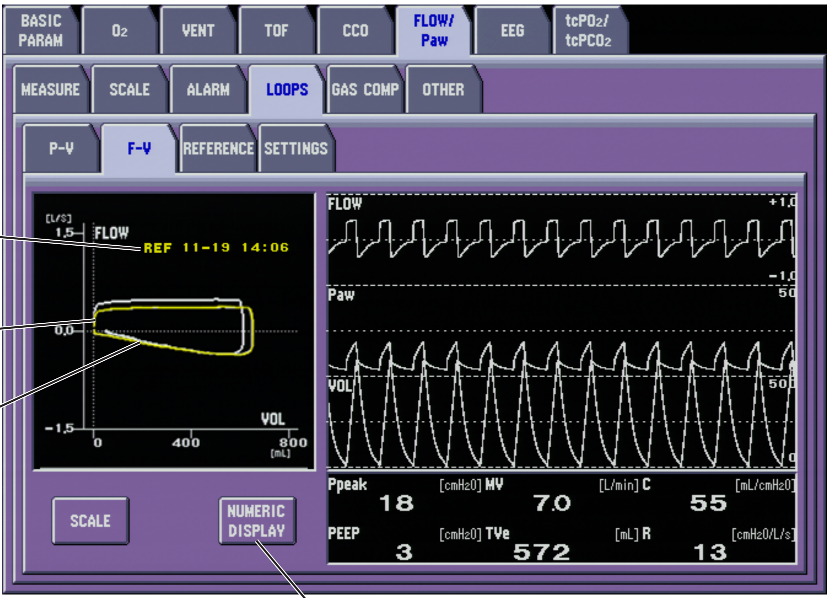
Date and time of the reference loop

Reference loop appears in yellow

P-V loop

NUMERIC DISPLAY
Display parameters can be selected on the NUMERIC DISPLAY window.

F-V loop: Press [Home] key → FLOW/Paw key → LOOPS tab → F-V tab.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[L/S]
1.5
FLOW
REF 11-19 14:06
0.0
-1.5
VOL
0
400
800
[mL]
FLOW
Paw
VOL
Ppeak
18
[cmH2O] MV
7.0
[L/min] C
55
[mL/cmH2O]
PEEP
3
[cmH2O] TVe
572
[mL] R
13
[cmH2O/L/s]
SCALE
NUMERIC DISPLAY

Date and time of the reference loop

Reference loop appears in yellow

F-V loop

NUMERIC DISPLAY
Display parameters can be selected on the NUMERIC DISPLAY window.

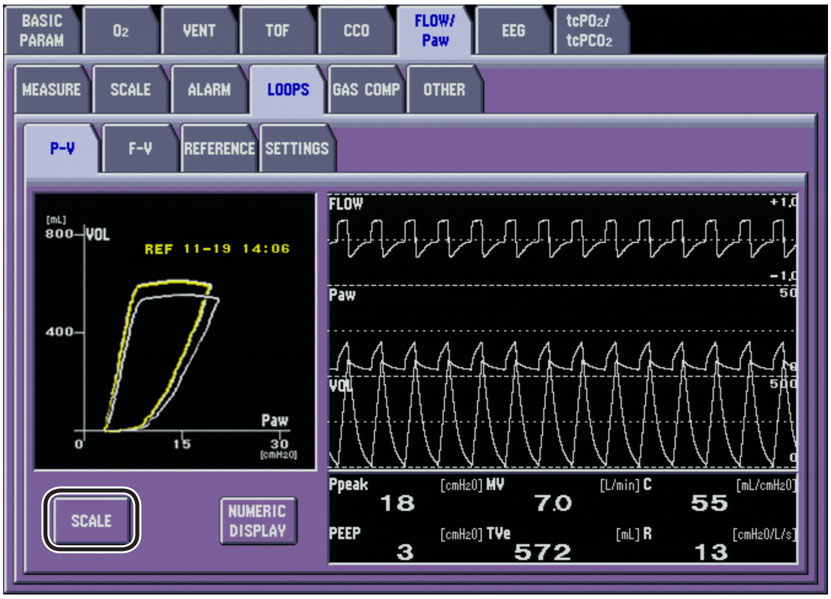
2. Press the [Home] key to return to the home screen.

Changing the Loop Graph Scale

The scale can be changed for the FLOW, Paw and volume. The same scale is used on both the home screen and FLOW/Paw window.

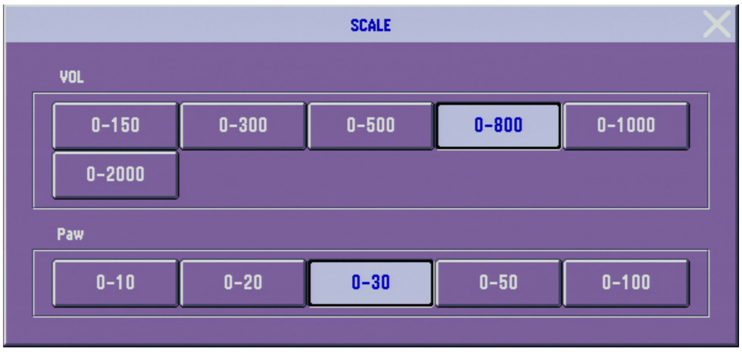
1. Display the LOOPS page for the desired loop type.
   P-V loop: Press [Home] key → FLOW/Paw key → LOOPS tab → P-V tab
   F-V loop: Press [Home] key → FLOW/Paw key → LOOPS tab → F-V tab

2. Touch the SCALE key to change the graph scale.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
400
0
15
30
Paw
[cmH2O]
REF 11-19 14:06
FLOW
+1.0
-1.0
Paw
50
0
VOL
500
0
Ppeak 18
[cmH2O] MV 7.0
[L/min] C 55
[mL/cmH2O]
PEEP 3
[cmH2O] TVe 572
[mL] R 13
[cmH2O/L/s]
SCALE
NUMERIC DISPLAY

3. Select the appropriate scale for each parameter.
   Paw: 0-10, 0-20, 0-30, 0-50, 0-100 (cmH_2O)
   VOL: 0-150, 0-300, 0-500, 0-800, 0-1000, 0-2000 (mL)
   FLOW: ±0.3, ±0.5, ±1.0, ±1.5, ±3.0 (L/s)

   i) Select the scale by touching the desired scale key.


SCALE
VOL
0-150
0-300
0-500
0-800
0-1000
0-2000
Paw
0-10
0-20
0-30
0-50
0-100

   ii) Touch the ☒ key to close the window.

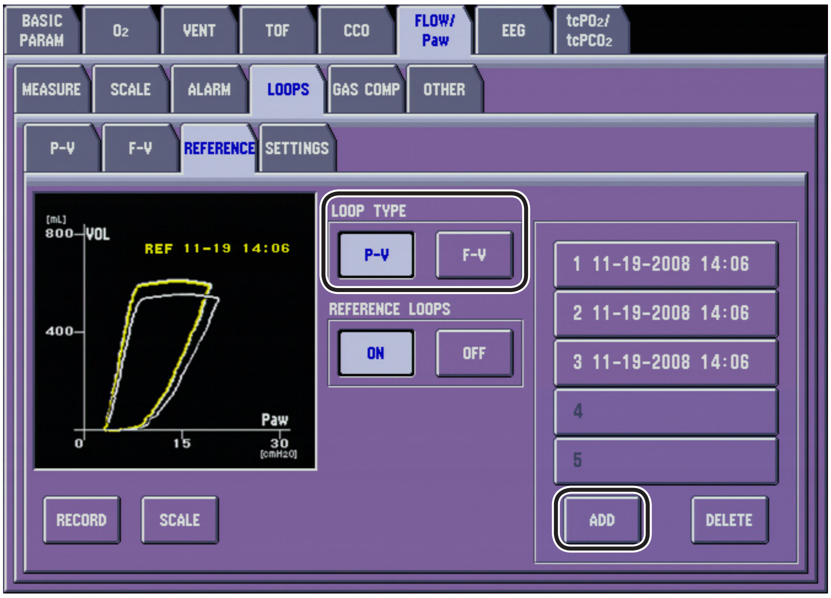
4. Press the [Home] key to return to the home screen.

Registering Reference Loops

Up to 5 P-V loops and 5 F-V loops can be registered as reference loops.

1. Display the REFERENCE page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → LOOPS tab → REFERENCE tab.

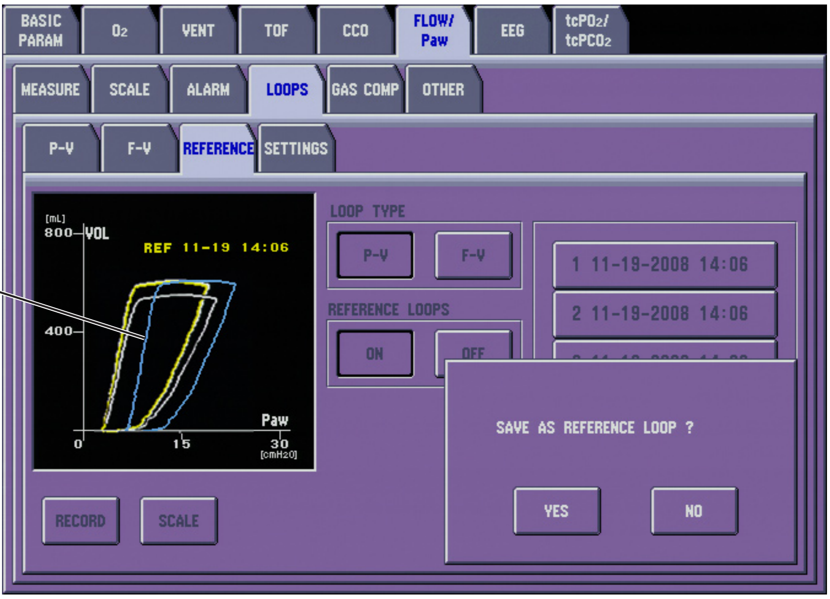
2. Select the loop type in the <LOOP TYPE> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
0
15
30
Paw
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
RECORD
SCALE
ADD
DELETE

1 11-19-2008 14:06
2 11-19-2008 14:06
3 11-19-2008 14:06
4
5

3. When the desired loop is displayed on the window, touch the ADD key. The confirmation message appears. The loop to be registered appears in blue.

4. Touch YES to register the loop as a reference loop.
   Touch NO to cancel registration.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
0
15
30
Paw
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
RECORD
SCALE
YES
NO

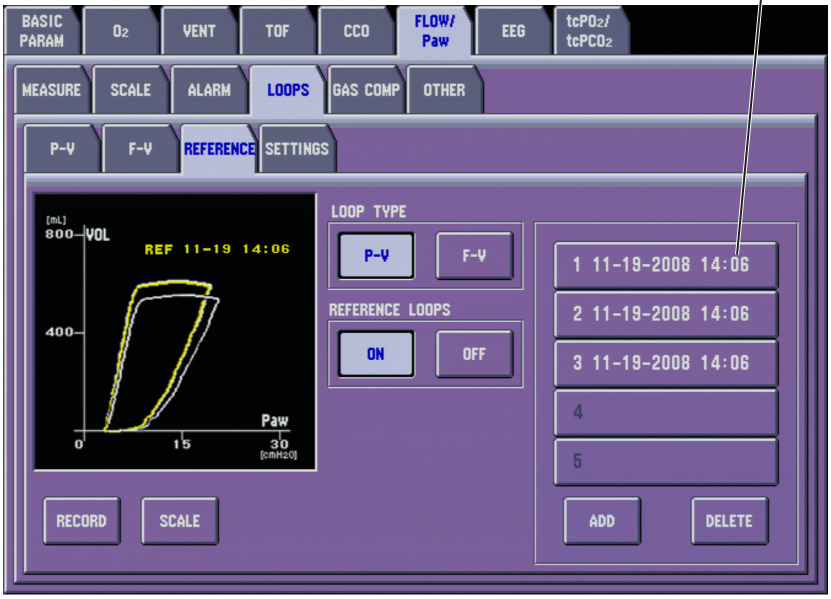
1 11-19-2008 14:06
2 11-19-2008 14:06

SAVE AS REFERENCE LOOP ?

Loop to be registered appears in blue

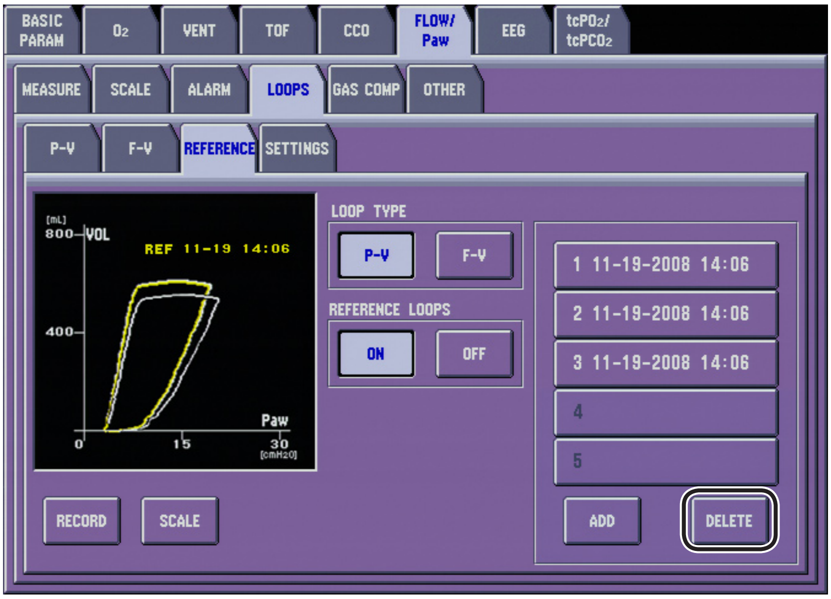
A new loop cannot be registered as a reference loop when 5 loops are already registered. To register another reference loop when there are already 5 reference loops, delete one reference loop.

Registered date and time is displayed.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
400
REF 11-19 14:06
Paw
0
15
30
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
1 11-19-2008 14:06
2 11-19-2008 14:06
3 11-19-2008 14:06
4
5
RECORD
SCALE
ADD
DELETE

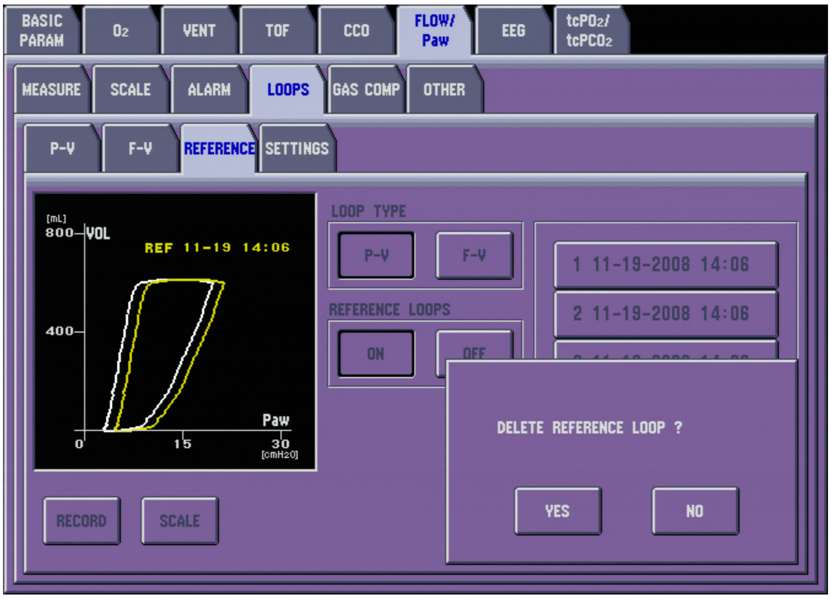
To delete a reference loop

i) Touch the key of the reference loop to be deleted.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
400
REF 11-19 14:06
Paw
0
15
30
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
1 11-19-2008 14:06
2 11-19-2008 14:06
3 11-19-2008 14:06
4
5
RECORD
SCALE
ADD
DELETE

ii) Touch the DELETE key. The confirmation message appears.

iii) Touch YES to delete the selected loop.
Touch NO to cancel deletion.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
0
15
Paw
30
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
1 11-19-2008 14:06
2 11-19-2008 14:06
DELETE REFERENCE LOOP ?
YES
NO
RECORD
SCALE

5. Press the [Home] key to return to the home screen.

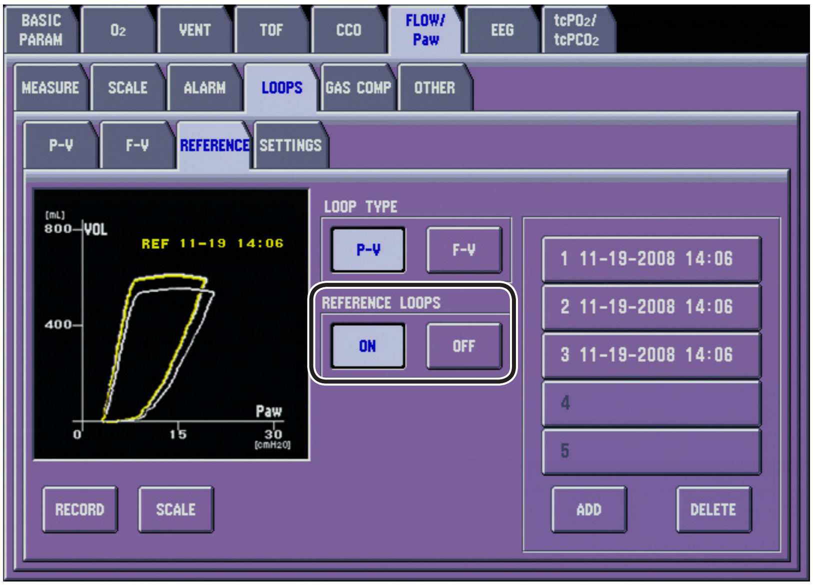
Turning Reference Loop Display On or Off

Select the reference loop display on the home screen and P-V tab or F-V tab of the LOOPS page.

1. Display the REFERENCE tab of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → LOOPS tab → REFERENCE tab.

2. Select ON or OFF in the <REFERENCE LOOP> box to set reference loop display on or off.

3. When <REFERENCE LOOPS> is set to ON, select the loop type and the reference loop from the registered reference loops.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
0
15
30
Paw
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
1 11-19-2008 14:06
2 11-19-2008 14:06
3 11-19-2008 14:06
4
5
RECORD
SCALE
ADD
DELETE

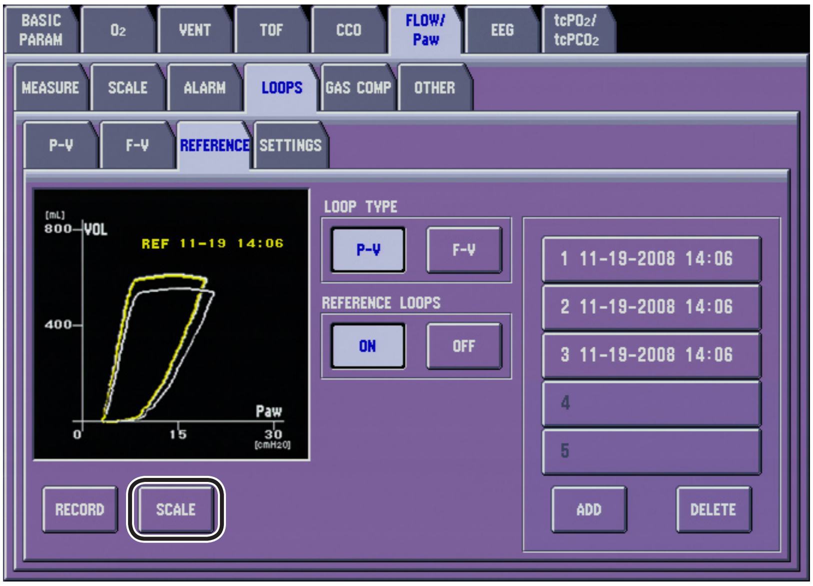
4. Press the [Home] key to return to the home screen.

Changing the Loop Graph Scale on the REFERENCE Tab

The scale can be changed for the FLOW, Paw and volume waveforms. The same scale is used on both the home screen and FLOW/Paw window.

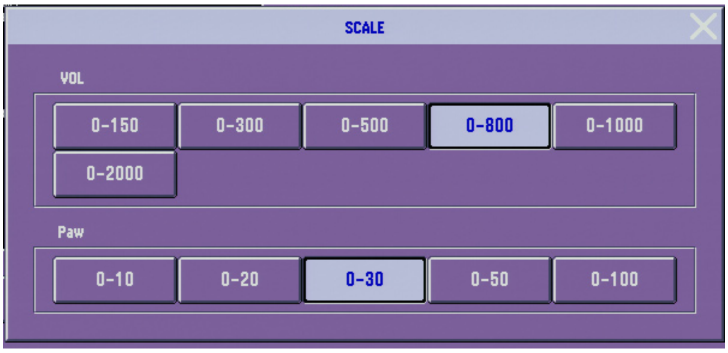
1. Display the REFERENCE tab of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → LOOPS tab → REFERENCE tab.

2. Touch the SCALE key to change the graph scale.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
0
15
30
Paw
[cmH2O]
LOOP TYPE
P-V
F-V
REFERENCE LOOPS
ON
OFF
1 11-19-2008 14:06
2 11-19-2008 14:06
3 11-19-2008 14:06
4
5
RECORD
SCALE
ADD
DELETE

3. Select the appropriate scale for each parameter.
   Paw: 0-10, 0-20, 0-30, 0-50, 0-100 (cmH_2O)
   VOL: 0-150, 0-300, 0-500, 0-800, 0-1000, 0-2000 (mL)
   FLOW: ±0.3, ±0.5, ±1.0, ±1.5, ±3.0 (L/s)

   i) Select the scale by touching the desired scale key.


SCALE
VOL
0-150
0-300
0-500
0-800
0-1000
0-2000
Paw
0-10
0-20
0-30
0-50
0-100

   ii) Touch the ☒ key to close the window.

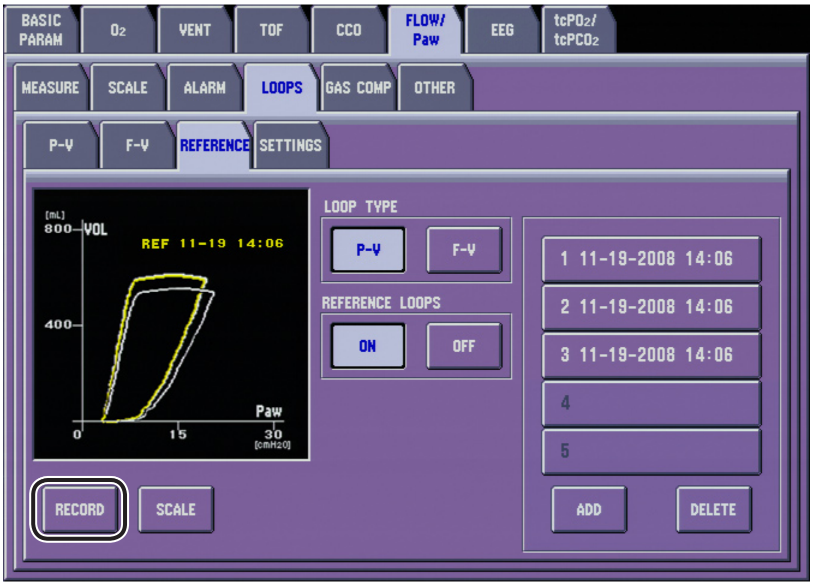
4. Press the [Home] key to return to the home screen.

Recording the Loops on the FLOW/Paw Window

The loops displayed on the FLOW/Paw window can be recorded with the numeric values on the optional recorder.

1. Display the REFERENCE tab of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → LOOPS tab → REFERENCE tab.

2. Touch the RECORD key. Recording starts.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
[mL]
800
VOL
REF 11-19 14:06
400
Paw
0
15
30
[cmH2O]
RECORD
SCALE
ADD
DELETE

LOOP TYPE: P-V / F-V

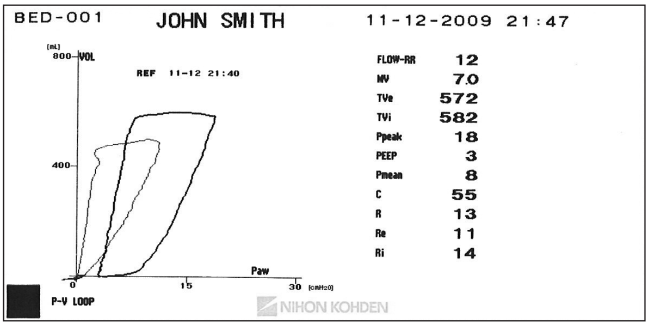
REFERENCE LOOPS: ON / OFF

1 11-19-2008 14:06
2 11-19-2008 14:06
3 11-19-2008 14:06
4
5

To stop recording, press the [Record] key.

3. Press the [Home] key to return to the home screen.

Recording example



BED-001 JOHN SMITH 11-12-2009 21:47

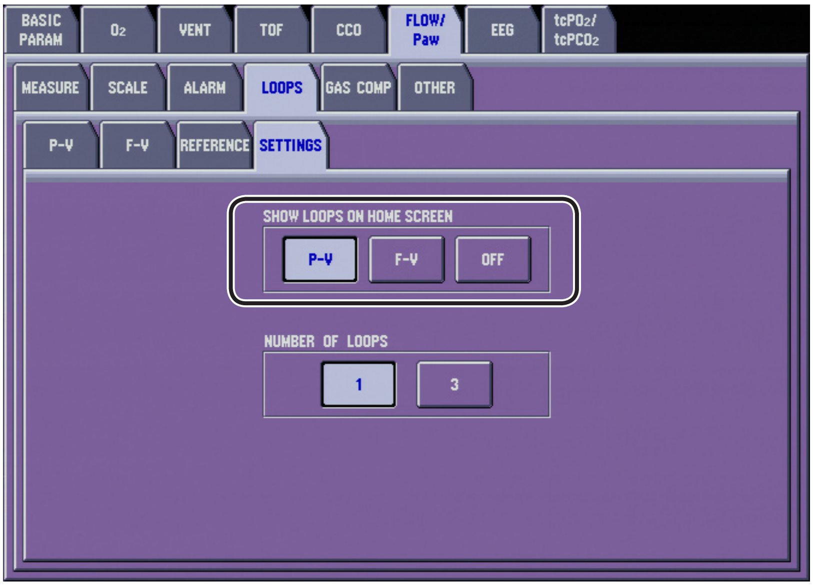
FLOW-RR	12
MV	7.0
TVe	572
TVi	582
Ppeak	18
PEEP	3
Pmean	8
C	55
R	13
Re	11
Ri	14

Changing the Loop Settings

Selecting the Loop Types to Display on the Home Screen

1. Display the SETTINGS tab of the LOOPS page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → LOOP tab → SETTINGS tab

2. Select the item from the <SHOW LOOPS ON HOME SCREEN> box.
   P-V: Displays P-V loop
   F-V: Displays F-V loop
   OFF: Displays only the numeric values


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
SHOW LOOPS ON HOME SCREEN
P-V
F-V
OFF
NUMBER OF LOOPS
1
3

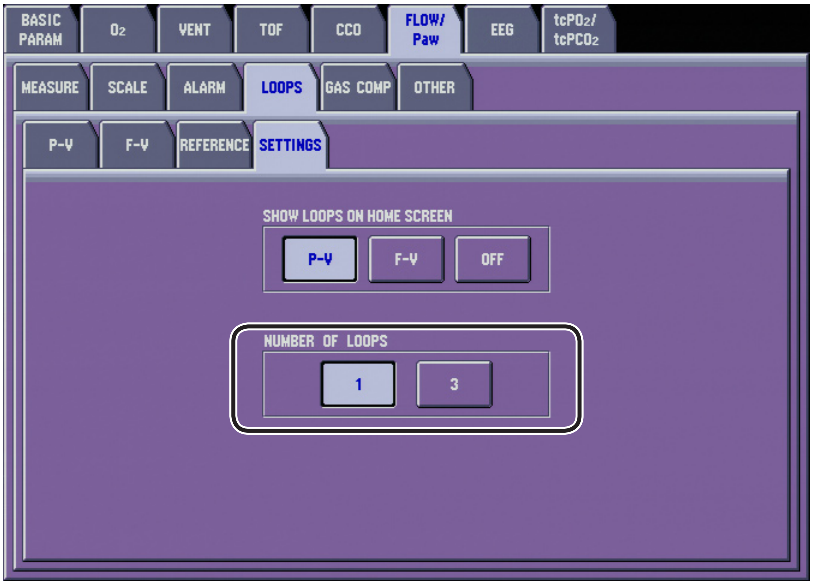
3. Press the [Home] key to return to the home screen.

Selecting the Number of Displayed Loops

Select 1 or 3 for the number of display loops. When the set number of loops are displayed, the loops are cleared from the screen when a new loop is drawn.

1. Display the SETTINGS tab of the LOOPS page of the FLOW/Paw window.
   Press [Menu] key → FLOW/Paw key → LOOP tab → SETTINGS tab

2. Select either 1 or 3 from the <NUMBER OF LOOPS> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
SCALE
ALARM
LOOPS
GAS COMP
OTHER
P-V
F-V
REFERENCE
SETTINGS
SHOW LOOPS ON HOME SCREEN
P-V
F-V
OFF
NUMBER OF LOOPS
1
3

3. Press the [Home] key to return to the home screen.

Section 16 EEG Monitoring

General 16.2
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Preparing for EEG Monitoring 16.3
Monitoring EEG 16.4
  EEG Information on the Home Screen 16.4
  EEG Information on the EEG Window 16.5
    Returning EEG Waveforms to the Baseline 16.5
    Displaying the Calibration Waveforms 16.5
Changing the EEG Settings 16.6
  Setting Montage 16.6
  Checking the Electrode Impedance 16.8
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  Changing the EEG Sensitivity 16.11
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  Recording the EEG Waveforms on the EEG Window 16.14
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    Recording All EEG Waveforms 16.14

NOTE

The AE-918P neuro unit is not available for BSM-6000A series.

General

EEG monitoring can be performed by using the AE-918P neuro unit. Up to 8 channels can be monitored.

List of Terms

Item	Description	Measuring Range
SEF	Spectral edge frequency The frequency below which the power spectrum contains 90 or 95% of the total power in the EEG.	0.0 to 62.5 Hz
MDF	Median frequency The frequency below which the power spectrum contains 50% of the total power in the EEG.	0.0 to 62.5 Hz
PPF	Peak power frequency The frequency of the highest power spectrum in the EEG.	0.0 to 62.5 Hz
TP	Total power	0 to 9.99 nW
%Delta	Power ratio of about 0.5 to 4 Hz* (delta wave)	0 to 100.0%
%Theta	Power ratio of about 4 to 8 Hz* (theta wave)	0 to 100.0%
%Alpha	Power ratio of about 8 to 13 Hz* (alpha wave)	0 to 100.0%
%Beta	Power ratio of about 13 to 30 Hz* (beta wave)	0 to 100.0%
%Gamma	Power ratio of about 30 to 60 Hz* (gamma wave)	0 to 100.0%
Abs Delta	Power of about 0.5 to 4 Hz* (delta wave)	0 to 9999 pW
Abs Theta	Power of about 4 to 8 Hz* (theta wave)	0 to 9999 pW
Abs Alpha	Power of about 8 to 13 Hz* (alpha wave)	0 to 9999 pW
Abs Beta	Power of about 13 to 30 Hz* (beta wave)	0 to 9999 pW
Abs Gamma	Power of about 30 to 60 Hz* (gamma wave)	0 to 9999 pW

* These values are the default settings. These values can be changed on the SYSTEM SETUP window. For details, refer to the Administrator's Guide.

Preparing for EEG Monitoring

1. Connect the neuro unit and bedside monitor.

2. Connect the EEG electrode leads to the EEG connection cord.

3. Connect the EEG connection cord to the neuro unit.

4. Attach the EEG electrodes to the patient.

5. Start measurement and change necessary settings.

For steps 1 to 4, refer to the AE-918P neuro unit operator’s manual.

WARNING

When using the JE-905P EEG connection cord, bundle all unused electrode leads. When using the JE-906P EEG connection cord, disconnect all unused electrode from the EEG connection cord. If the unused electrode or electrode lead touches a metal object or any other conductive parts, the patient may receive electrical shock.

WARNING

When using the JE-906P EEG connection cord and the bedside monitor is connected to a central monitor network, EEG values and waveforms are not output to the central monitor from the bedside monitor. No data or alarm regarding the EEG data from the neuro unit are displayed on the central monitor. Be careful on EEG monitoring when the bedside monitor is connected to a central monitor network.

Monitoring EEG

After completing the preparation, EEG data and waveforms appear on the screen.

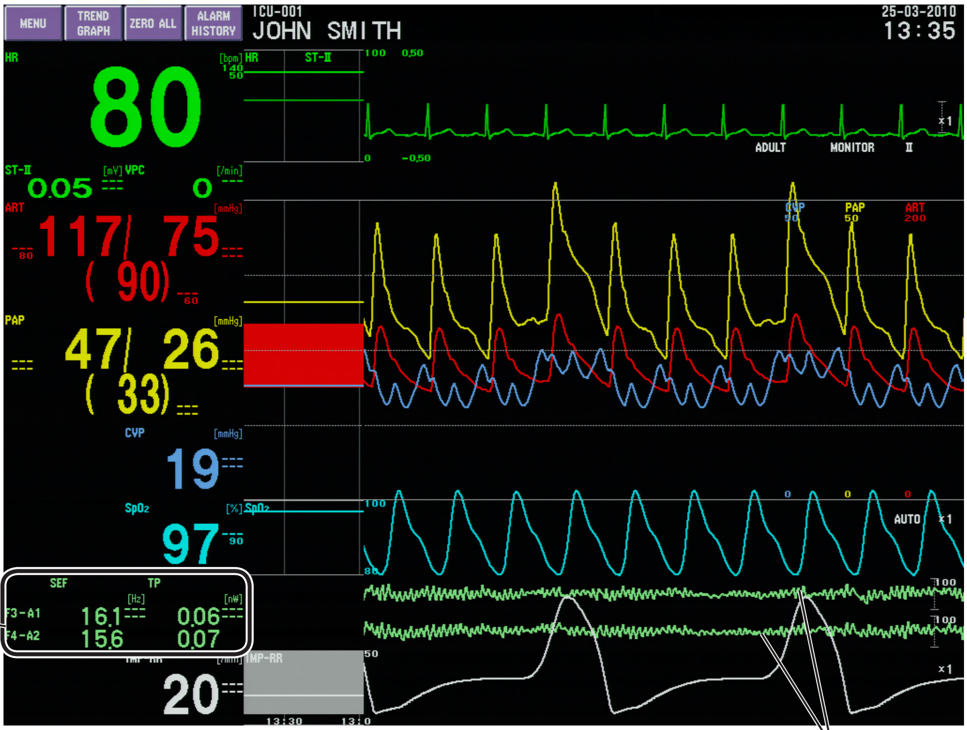
WARNING

When abnormal waveforms appear (flat waveform or a lot of AC interference), remove all electrodes from the patient and stop using the neuro unit.

CAUTION

Do not use the needle electrodes for more than one hour as a measurement electrode for the EEG. When measuring the EEG for over one hour, use the EEG disk electrode.

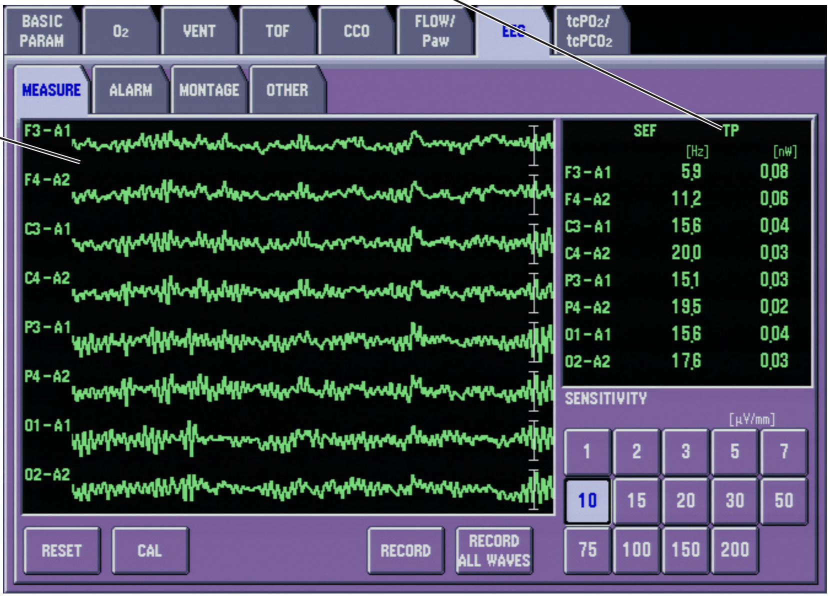
EEG Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
25-03-2010
13:35
HR
80
ST-II
0.05
VPC
0
ART
117/ 75
(90)
PAP
47/ 26
(33)
CVP
19
SpO2
97
SEF
TP
F3-A1
F4-A2
16.1
15.6
0.06
0.07
IMP-RR
20
ADULT
MONITOR
II
AUTO

EEG values
Two parameters selected on the DISPLAY tab of the OTHER page of the EEG window appear.

EEG waveforms

EEG Information on the EEG Window


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
F3-A1
F4-A2
C3-A1
C4-A2
P3-A1
P4-A2
O1-A1
O2-A2
SENSITIVITY
[µV/mm]
1
2
3
5
7
10
15
20
30
50
75
100
150
200
RESET
CAL
RECORD
RECORD ALL WAVES

	SEF [Hz]	TP [nW]
F3-A1	5.9	0.08
F4-A2	11.2	0.06
C3-A1	15.6	0.04
C4-A2	20.0	0.03
P3-A1	15.1	0.03
P4-A2	19.5	0.02
O1-A1	15.6	0.04
O2-A2	17.6	0.03

Numeric values of the parameters selected for PARAMETERS PAIR on the DISPLAY tab of the OTHER page of the EEG window

EEG waveforms of the channels selected on the OTHER tab of the MONTAGE page

Returning EEG Waveforms to the Baseline

Touch the RESET key to return all EEG waveforms to the baseline position when artifacts are on the waveforms or the baseline is wandering.

Displaying the Calibration Waveforms

Touch the CAL key to display the calibration waveforms.

Changing the EEG Settings

Change the settings on the EEG window. The following settings can be changed for EEG monitoring.

- SEF and TP alarm limits
- EEG waveform sensitivity
- Montage
- Check impedance
- SEF (spectral edge frequency)
- Filters
- Parameters for the home screen
- Amplitude limiting

Automatic impedance check on or off and frequency band settings for EEG are set on the SYSTEM SETUP window. For details, refer to Section 3 of the Administrator's Guide.

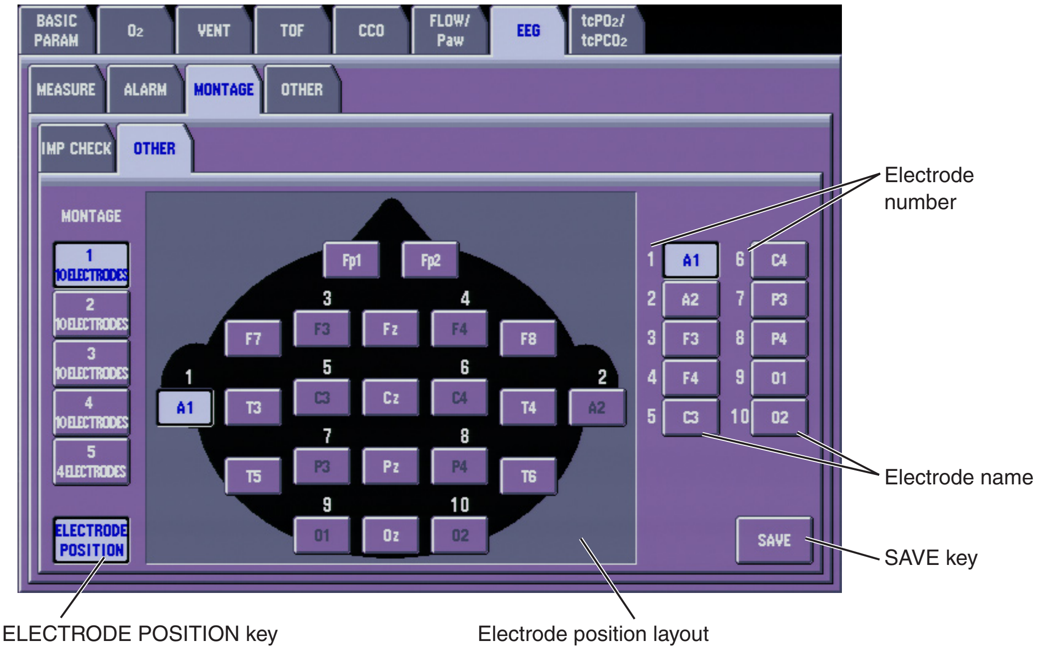
The EEG data display color can be set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator's Guide.

Setting Montage

Set the electrode position and montage on the MONTAGE page.

1. Display the OTHER tab of the MONTAGE page on the EEG window.
   Press [Menu] key → EEG key → MONTAGE tab → OTHER tab.

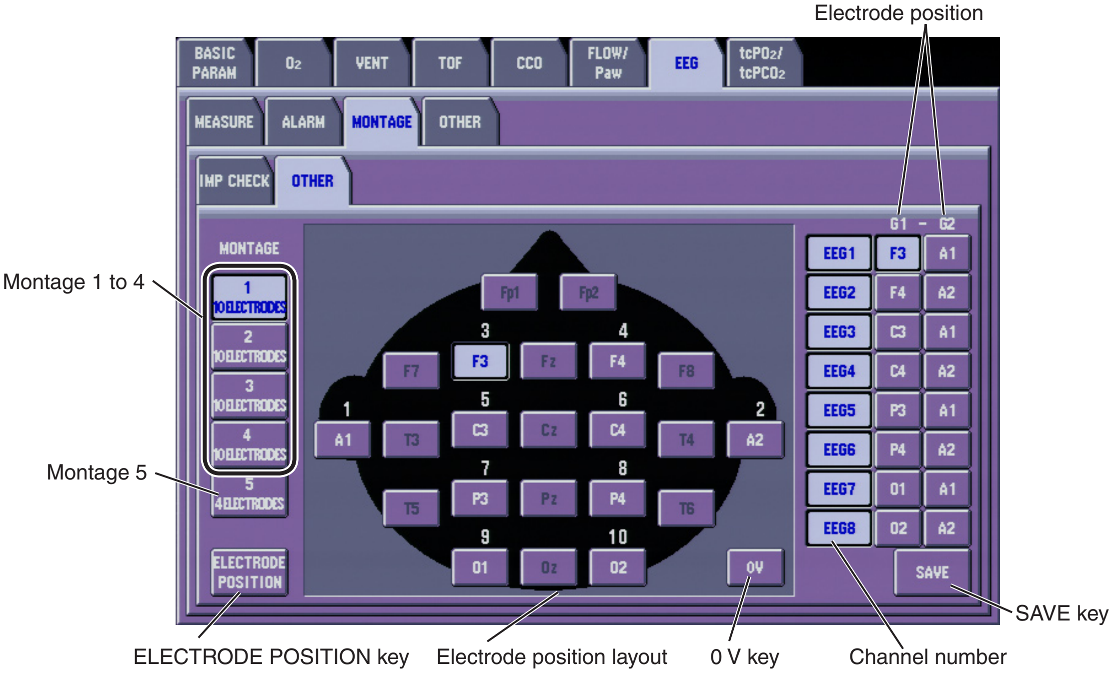
2. Change the electrode positions if necessary.
   i) Touch the ELECTRODE POSITION key.
   ii) Assign the electrode position to each electrode by touching the electrode name key for the electrode number and selecting the position from the electrode position layout.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
IMP CHECK
OTHER
MONTAGE
1 10ELECTRODES
2 10ELECTRODES
3 10ELECTRODES
4 10ELECTRODES
5 4ELECTRODES
ELECTRODE POSITION
Fp1
Fp2
F7
F3
Fz
F4
F8
A1
T3
C3
Cz
C4
T4
A2
T5
P3
Pz
P4
T6
O1
Oz
O2
1 A1
2 A2
3 F3
4 F4
5 C3
6 C4
7 P3
8 P4
9 O1
10 O2
SAVE
Electrode number
Electrode name
SAVE key
ELECTRODE POSITION key
Electrode position layout

iii) To save the changed electrode positions, touch the SAVE key.

iv) Touch the ELECTRODE POSITION key again to display the montage.

3. Select a montage from 1 to 4 when using 10 electrodes.
   Select montage 5 when using 4 electrodes.


Electrode position
BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
IMP CHECK
OTHER
MONTAGE
1 10ELECTRODES
2 10ELECTRODES
3 10ELECTRODES
4 10ELECTRODES
5 4ELECTRODES
ELECTRODE POSITION
G1 – G2
EEG1 F3 A1
EEG2 F4 A2
EEG3 C3 A1
EEG4 C4 A2
EEG5 P3 A1
EEG6 P4 A2
EEG7 O1 A1
EEG8 O2 A2
0V
SAVE
Montage 1 to 4
Montage 5
ELECTRODE POSITION key
Electrode position layout
0 V key
Channel number
SAVE key

4. If necessary, change the montage. If Montage 5 (for 4 electrodes) is selected, the montage cannot be changed.

   i) Touch the electrode position of the channel you want to change the combination.

   ii) Select the electrode position from the electrode position layout.
   Use the 0 V key to display the original electrode potential.

   iii) To save the montage settings, touch the SAVE key.

5. Press the [Home] key to return to the home screen.

Checking the Electrode Impedance

CAUTION

Never check the skin-electrode impedance with the needle electrode inserted in the patient. Failure to follow this caution causes electrical burn where electrodes are inserted.

Check the impedance between the electrodes and skin. Always check the impedance after attaching electrodes on the patient.

The impedance check result according to the set threshold appears every time the impedance is checked. If the check result is not “PASS”, remove the cause and repeat the impedance check until the result becomes “PASS”.

The impedance check can be performed automatically or manually. Impedance auto check on or off is set on the SYSTEM SETUP window. Refer to Section 3 of the Administrator’s Guide.

Auto check:	When auto check is turned ON, the measurement signals of two types of frequencies higher than the EEG frequency band are applied to check impedance while measuring EEG. If the result is not “PASS”, the “CHECK ELECTRODES” or “HIGH IMPEDANCE” message appears on the screen. The impedance for the Z electrode cannot be automatically checked. Check impedance for the Z electrode manually.
Manual check:	Impedance for all electrodes are checked while the START key for <MANUAL CHECK> is pressed. The measurement signal of the frequency within the EEG frequency band are applied to check impedance of all electrodes including the Z electrode.

NOTE

It is recommended to use auto impedance check function so that an electrode off, lead disconnection and high impedance of an electrode can be automatically detected. However, noise from the automatic impedance check may affect other devices. In such a case, set the automatic impedance check to OFF.

Automatically Checking Impedance

When auto check is turned ON, impedance is automatically checked while measuring EEG. If the result is not “PASS”, the “CHECK ELECTRODES” or “HIGH IMPEDANCE” message appears on the screen.

The impedance for the Z electrode cannot be automatically checked. Check impedance for the Z electrode manually.

Manually Checking Impedance

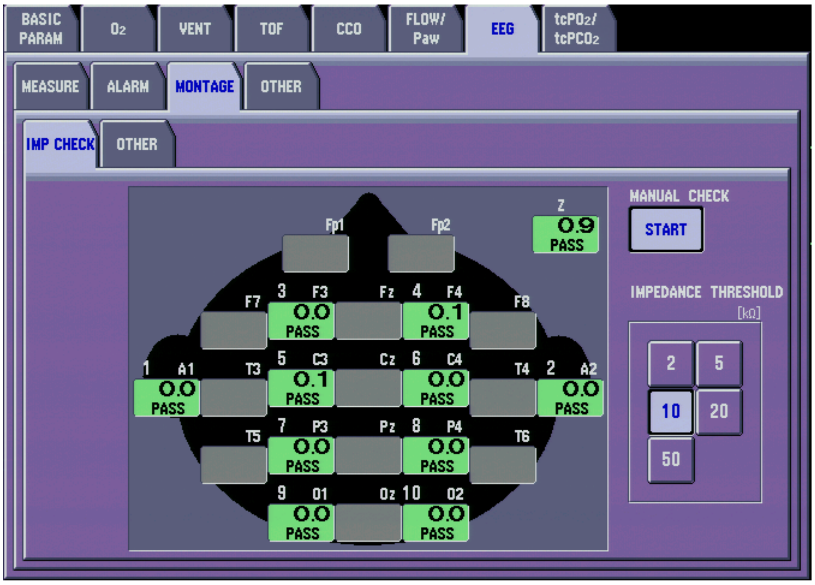
Check the impedance manually whenever necessary. Data is not acquired during manual impedance check.

1. Display the IMP CHECK tab of the MONTAGE page on the EEG window.
   Press [Menu] key → EEG key → MONTAGE tab → IMP CHECK tab.

2. Select the threshold in the <IMPEDANCE THRESHOLD> box.

3. Touch the START key in the <MANUAL CHECK> box.
   To cancel impedance check, touch the START key again.

   The check result appears.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
IMP CHECK
OTHER
Z 0.9 PASS
Fp1
Fp2
F7
3 F3 0.0 PASS
Fz
4 F4 0.1 PASS
F8
1 A1 0.0 PASS
T3
5 C3 0.1 PASS
Cz
6 C4 0.0 PASS
T4
2 A2 0.0 PASS
T5
7 P3 0.0 PASS
Pz
8 P4 0.0 PASS
T6
9 O1 0.0 PASS
Oz
10 O2 0.0 PASS
MANUAL CHECK
START
IMPEDANCE THRESHOLD
[kΩ]
2
5
10
20
50

PASS:	The impedance check is OK.
HIGH:	The impedance is high. Clean the electrode attachment site with alcohol and attach the electrode again.
LEAD OFF or – – –:	Electrode is detached or the lead is loose or disconnected. Check the electrode attachment and lead connection. If the “LEAD OFF” message still appears, clean the electrode attachment site with alcohol.

4. Press the [Home] key to return to the home screen.

Changing the SEF and TP Alarm Limits

CAUTION

When the alarm limit is set to OFF, there will be no alarm for that limit. Depending on the setting, the alarm off mark might not be displayed on the screen. Be careful when you set the alarm limit to OFF.

You can set the upper and lower SEF and TP alarm limits on the EEG window. You can set all alarms, including the upper and lower SEF and TP alarm limits, on the ALARM LIMITS window (See Operator's Manual or Section 5 of the User's Guide Part I).

Setting Range

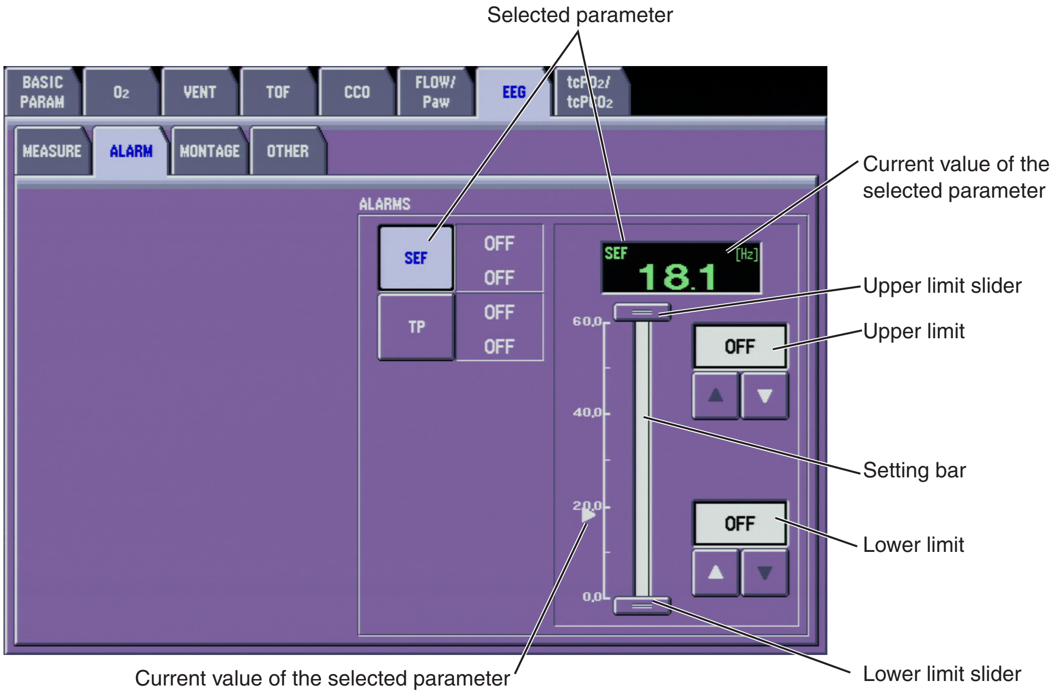
SEF upper limit:	1.0 to 60.0 Hz in 0.5 Hz steps, OFF (default setting: OFF)
SEF lower limit:	OFF, 0.5 to 59.5 Hz in 0.5 Hz steps (default setting: OFF)
TP upper limit:	0.02 to 9.99 nW in 0.01 nW steps, OFF (default setting: OFF)
TP lower limit:	OFF, 0.01 to 9.98 nW in 0.01 nW steps (default setting: OFF)

1. Display the ALARM page on the EEG window.
   Press [Menu] key → EEG key → ALARM tab.

2. Touch the SEF key to change the SEF alarm setting.
   Touch the TP key to change the TP alarm setting.

3. Touch and drag the sliders to the desired level on the setting bar. Use the ▲ or ▼ key to adjust the setting.

   If the upper limit is set to a value above the maximum, the upper limit alarm is set to OFF. If the lower limit is set to a value below the minimum, the lower limit alarm is set to OFF.


Selected parameter
BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
ALARMS
SEF
OFF
OFF
TP
OFF
OFF
SEF
[Hz]
18.1
60.0
40.0
20.0
0.0
OFF
OFF
Current value of the selected parameter
Upper limit slider
Upper limit
Setting bar
Lower limit
Lower limit slider
Current value of the selected parameter

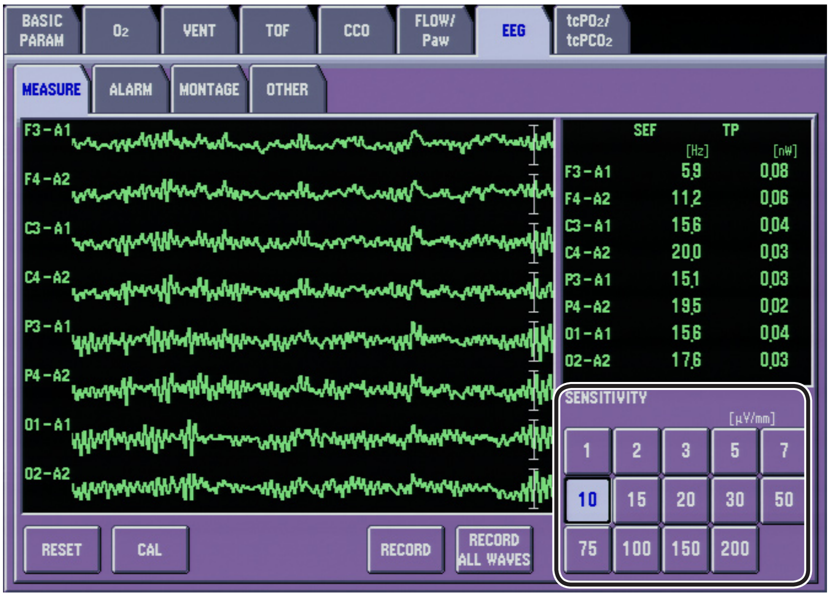
4. Press the [Home] key to return to the home screen.

Changing the EEG Sensitivity

The sensitivity determines the amplitude of the EEG waveform on both the screen and recording paper.

1. Display the MEASURE page on the EEG window.
   Press [Menu] key → EEG key → MEASURE tab.

2. Select the sensitivity from the <SENSITIVITY> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
F3-A1
F4-A2
C3-A1
C4-A2
P3-A1
P4-A2
O1-A1
O2-A2
SENSITIVITY
[μV/mm]
1
2
3
5
7
10
15
20
30
50
75
100
150
200
RESET
CAL
RECORD
RECORD ALL WAVES

	SEF [Hz]	TP [nW]
F3-A1	5.9	0.08
F4-A2	11.2	0.06
C3-A1	15.6	0.04
C4-A2	20.0	0.03
P3-A1	15.1	0.03
P4-A2	19.5	0.02
O1-A1	15.6	0.04
O2-A2	17.6	0.03

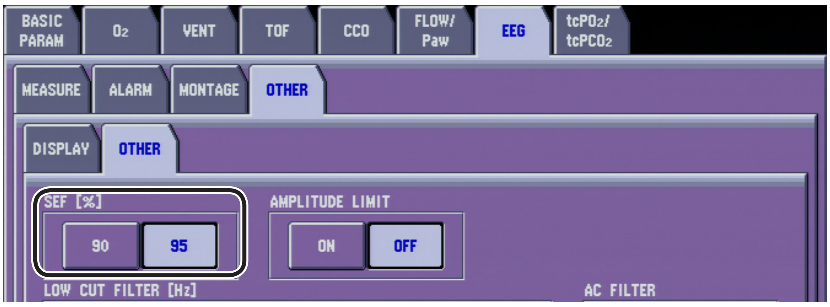
3. Press the [Home] key to return to the home screen.

Selecting the Edge Frequency for SEF

Select the edge frequency for the SEF display.

1. Display the OTHER tab of the EEG window.
   Press [Menu] key → EEG key → OTHER tab → OTHER tab.

2. Select 90 or 95 in the <SEF> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
DISPLAY
OTHER
SEF [%]
90
95
AMPLITUDE LIMIT
ON
OFF
LOW CUT FILTER [Hz]
AC FILTER

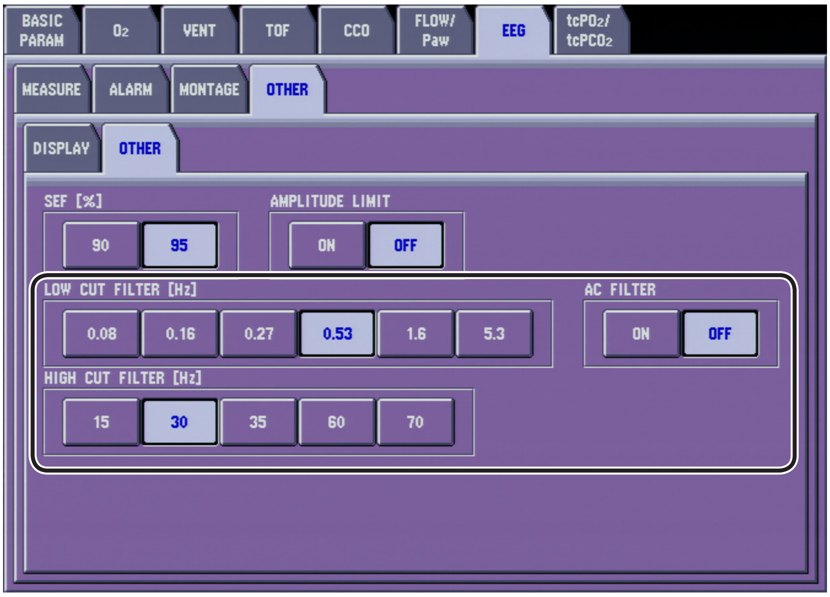
3. Press the [Home] key to return to the home screen.

Changing the Filter Settings

Select the high-cut filter and low-cut filter and turn AC filter on or off. These settings are applied on both the home screen and EEG window.

1. Display the OTHER tab of the EEG window.
   Press [Menu] key → EEG key → OTHER tab → OTHER tab.

2. Select the low-cut filter from the <LOW CUT FILTER> box.
   Select the high-cut filter from the <HIGH CUT FILTER> box.
   Turn the AC filter ON or OFF in the <AC FILTER> box.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
DISPLAY
OTHER
SEF [%]
90
95
AMPLITUDE LIMIT
ON
OFF
LOW CUT FILTER [Hz]
0.08
0.16
0.27
0.53
1.6
5.3
AC FILTER
ON
OFF
HIGH CUT FILTER [Hz]
15
30
35
60
70

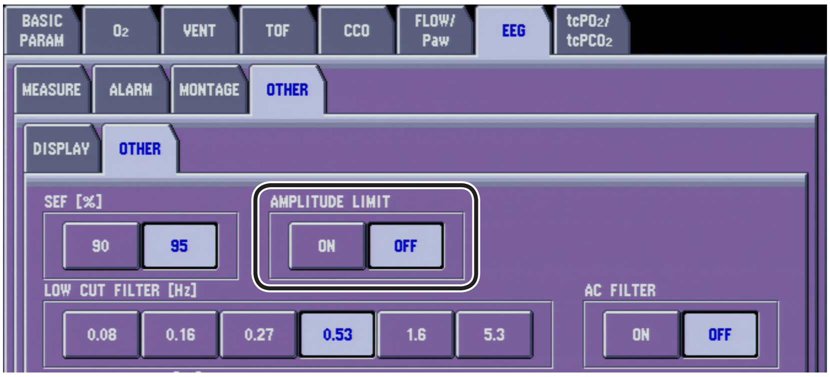
3. Press the [Home] key to return to the home screen.

Limiting the EEG Amplitude

When the EEG amplitude on the home screen is large and EEG overlaps other waveforms, limit the EEG amplitude.

1. Display the OTHER tab of the EEG window.
   Press [Menu] key → EEG key → OTHER tab → OTHER tab.

2. Select ON or OFF in the <AMPLITUDE LIMIT> box.

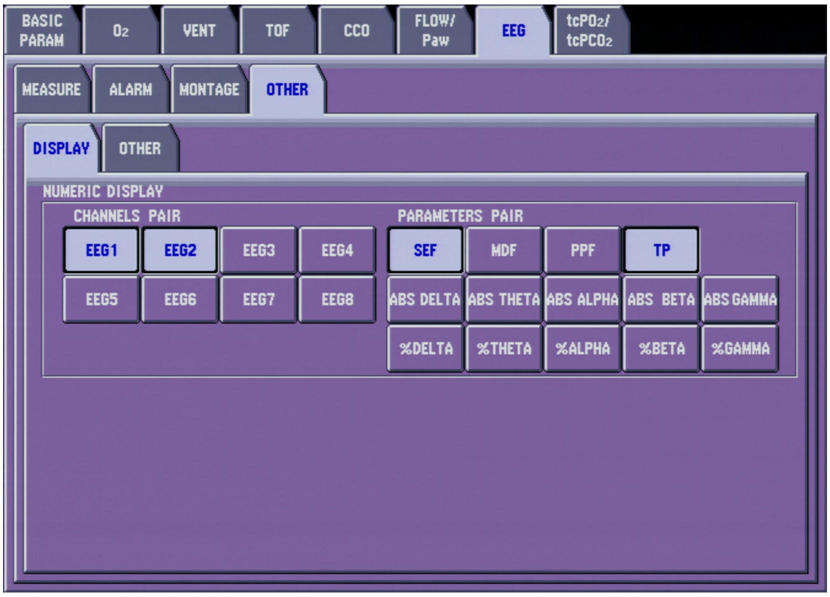

BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
DISPLAY
OTHER
SEF [%]
90
95
AMPLITUDE LIMIT
ON
OFF
LOW CUT FILTER [Hz]
0.08
0.16
0.27
0.53
1.6
5.3
AC FILTER
ON
OFF

3. Press the [Home] key to return to the home screen.

Selecting Channels and Parameters to Display on the Home Screen

Select the channels and parameters to display in the numeric display area on the home screen. Up to 2 channels and 2 parameters can be selected.

1. Display the DISPLAY tab of the EEG window.
   Press [Menu] key → EEG key → OTHER tab → DISPLAY tab.


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
DISPLAY
OTHER
NUMERIC DISPLAY
CHANNELS PAIR
EEG1
EEG2
EEG3
EEG4
EEG5
EEG6
EEG7
EEG8
PARAMETERS PAIR
SEF
MDF
PPF
TP
ABS DELTA
ABS THETA
ABS ALPHA
ABS BETA
ABS GAMMA
%DELTA
%THETA
%ALPHA
%BETA
%GAMMA

2. Select two channels in the <CHANNELS PAIR> box.

3. Select two parameters in the <PARAMETERS PAIR> box.

4. Press the [Home] key to return to the home screen.

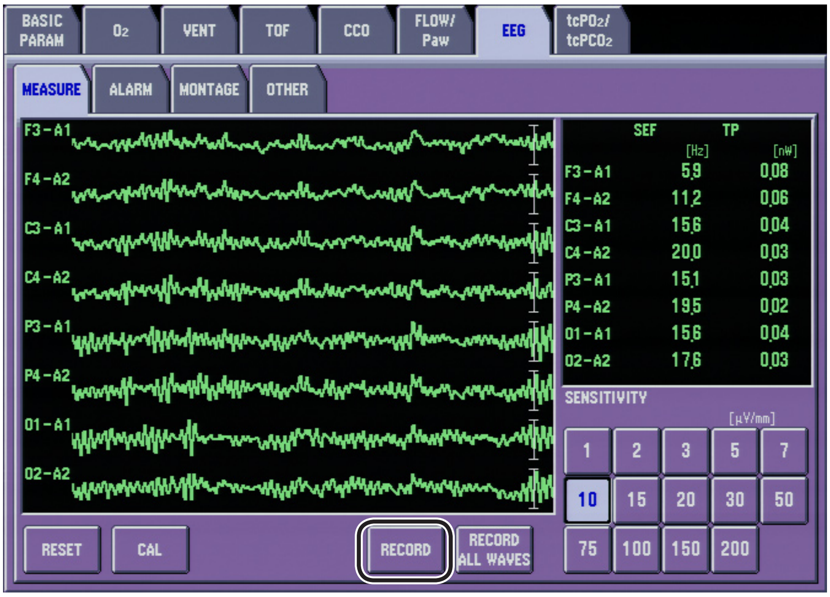
Recording the EEG Waveforms on the EEG Window

Recording the EEG Waveforms on the EEG Window

The EEG waveforms displayed on the EEG window can be recorded with the numeric values on the optional recorder.

1. Display the MEASURE page on the EEG window.
   Press [Menu] key → EEG key → MEASURE tab.

2. Touch the RECORD key. Recording starts.

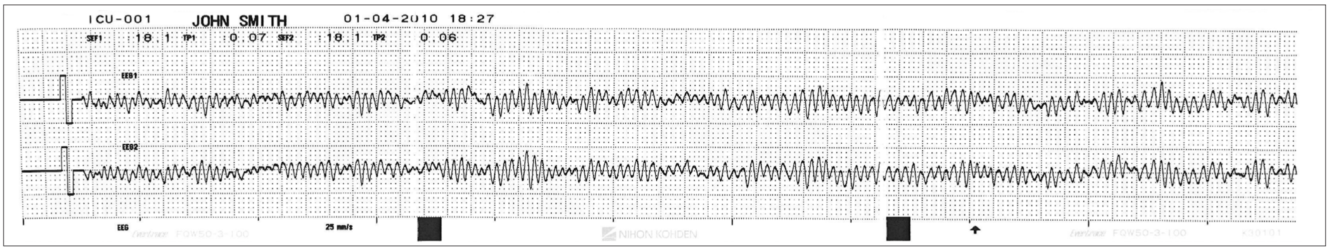

BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
F3-A1
F4-A2
C3-A1
C4-A2
P3-A1
P4-A2
O1-A1
O2-A2
SENSITIVITY
[μV/mm]
1
2
3
5
7
10
15
20
30
50
75
100
150
200
RESET
CAL
RECORD
RECORD ALL WAVES

	SEF [Hz]	TP [nW]
F3-A1	5.9	0.08
F4-A2	11.2	0.06
C3-A1	15.6	0.04
C4-A2	20.0	0.03
P3-A1	15.1	0.03
P4-A2	19.5	0.02
O1-A1	15.6	0.04
O2-A2	17.6	0.03

To stop recording, press the [Record] key.

3. Press the [Home] key to return to the home screen.

Recording example

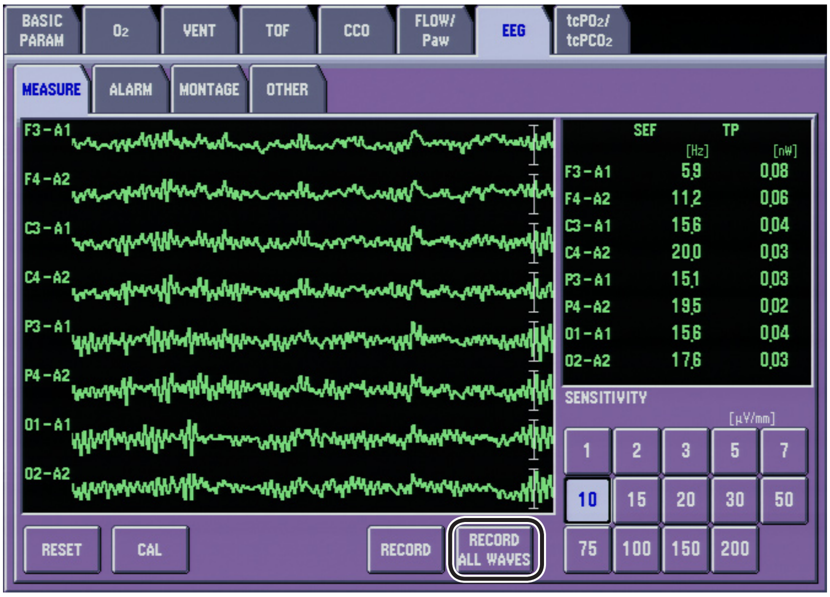


Recording All EEG Waveforms

10 seconds of EEG waveforms with numeric values for each channel can be recorded on the optional recorder.

1. Display the MEASURE page on the EEG window.
   Press [Menu] key → EEG key → MEASURE tab.

2. Touch the RECORD ALL WAVES key. Recording starts.

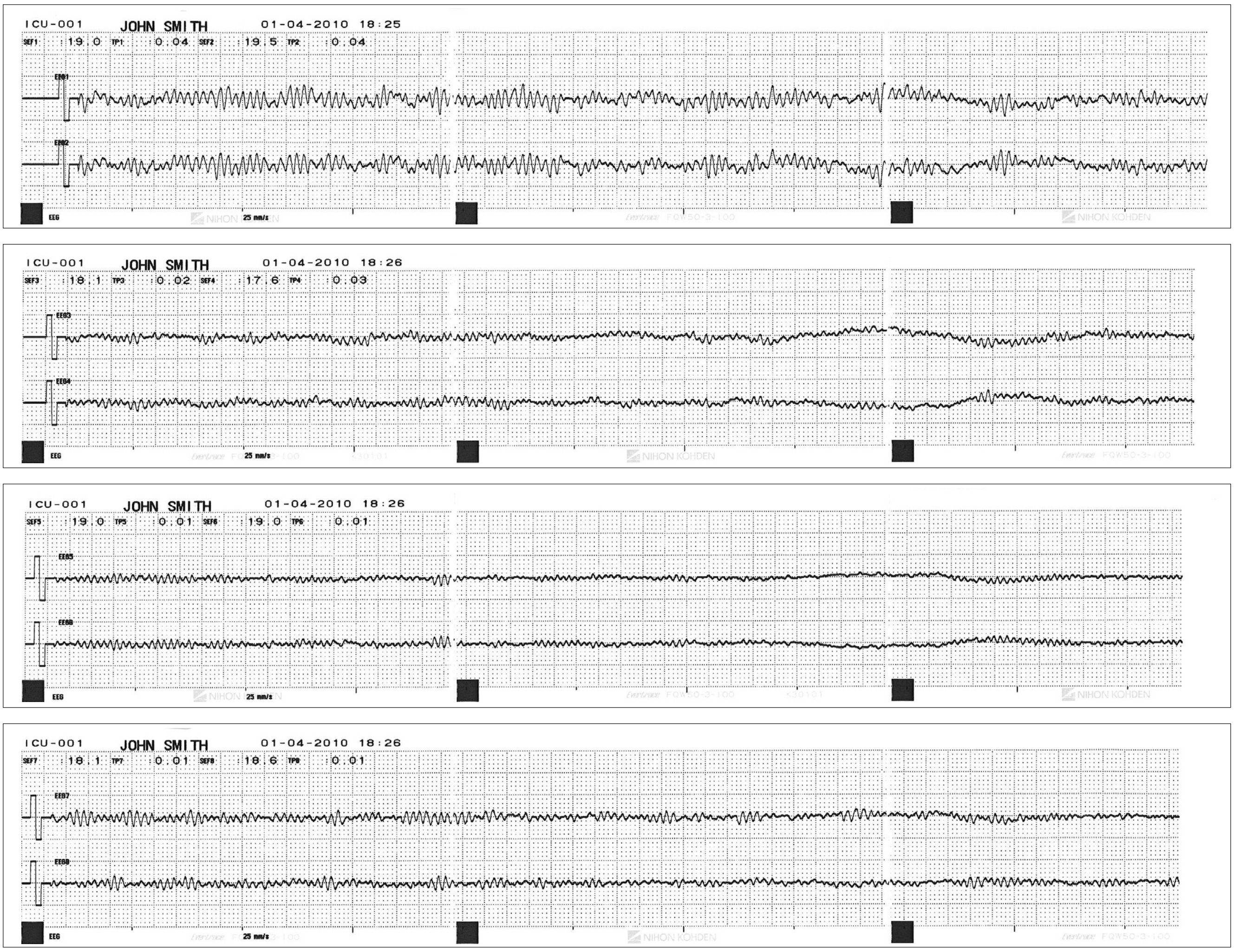

BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE
ALARM
MONTAGE
OTHER
F3-A1
F4-A2
C3-A1
C4-A2
P3-A1
P4-A2
O1-A1
O2-A2
SENSITIVITY
[μV/mm]
1
2
3
5
7
10
15
20
30
50
75
100
150
200
RESET
CAL
RECORD
RECORD ALL WAVES

	SEF [Hz]	TP [nW]
F3-A1	5.9	0.08
F4-A2	11.2	0.06
C3-A1	15.6	0.04
C4-A2	20.0	0.03
P3-A1	15.1	0.03
P4-A2	19.5	0.02
O1-A1	15.6	0.04
O2-A2	17.6	0.03

To stop recording, press the ⍄ [Record] key.

3. Press the [Home] key to return to the home screen.

Recording example


ICU-001 JOHN SMITH 01-04-2010 18:25
SEF1 : 19.0 TP1 : 0.04 SEF2 : 19.5 TP2 : 0.04

ICU-001 JOHN SMITH 01-04-2010 18:26
SEF3 : 18.1 TP3 : 0.02 SEF4 : 17.6 TP4 : 0.03

ICU-001 JOHN SMITH 01-04-2010 18:26
SEF5 : 19.0 TP5 : 0.01 SEF6 : 19.0 TP6 : 0.01

ICU-001 JOHN SMITH 01-04-2010 18:26
SEF7 : 18.1 TP7 : 0.01 SEF8 : 18.6 TP8 : 0.01

Section 17 $tcPO_2/tcPCO_2$ Monitoring

General 17.2
    List of Terms 17.2
    Preparing for $tcPO_2/tcPCO_2$ Monitoring 17.2
Monitoring $tcPO_2/tcPCO_2$ 17.3
    $tcPO_2/tcPCO_2$ Information on the Home Screen 17.3
    $tcPO_2/tcPCO_2$ Information on the $tcPO_2/tcPCO_2$ Window 17.4

General

Transcutaneous blood gas monitoring can be performed by connecting a Radiometer transcutaneous monitor to the bedside monitor. To connect the transcutaneous monitor to the bedside monitor, the IF-913P or IF-914P communication cable is required.

IF-913P: For connecting MicroGas 7650 *rapid* transcutaneous monitor
IF-914P: For connecting TCM4 or TCM40 transcutaneous monitor

List of Terms

Label	Name	Unit
$tcPO_2$	Transcutaneous oxygen partial pressure	mmHg or kPa*
$tcPCO_2$	Transcutaneous carbon dioxide partial pressure	mmHg or kPa*
TEMP	Sensor temperature	°C or °F*
POWER	Electrode heating power	mW

* The temperature unit (°C or °F) and $tcPO_2/PCO_2$ pressure unit (mmHg or kPa) can be changed on the SYSTEM CONFIGURATION screen of the bedside monitor.

Preparing for $tcPO_2/tcPCO_2$ Monitoring

1. Set up the transcutaneous monitor and connect it to the bedside monitor. Refer to the IF-913P or IF-914P communication cable manual.

2. Connect the transcutaneous monitor to the patient. Refer to the transcutaneous monitor manual.

3. Start measurement and change necessary settings.

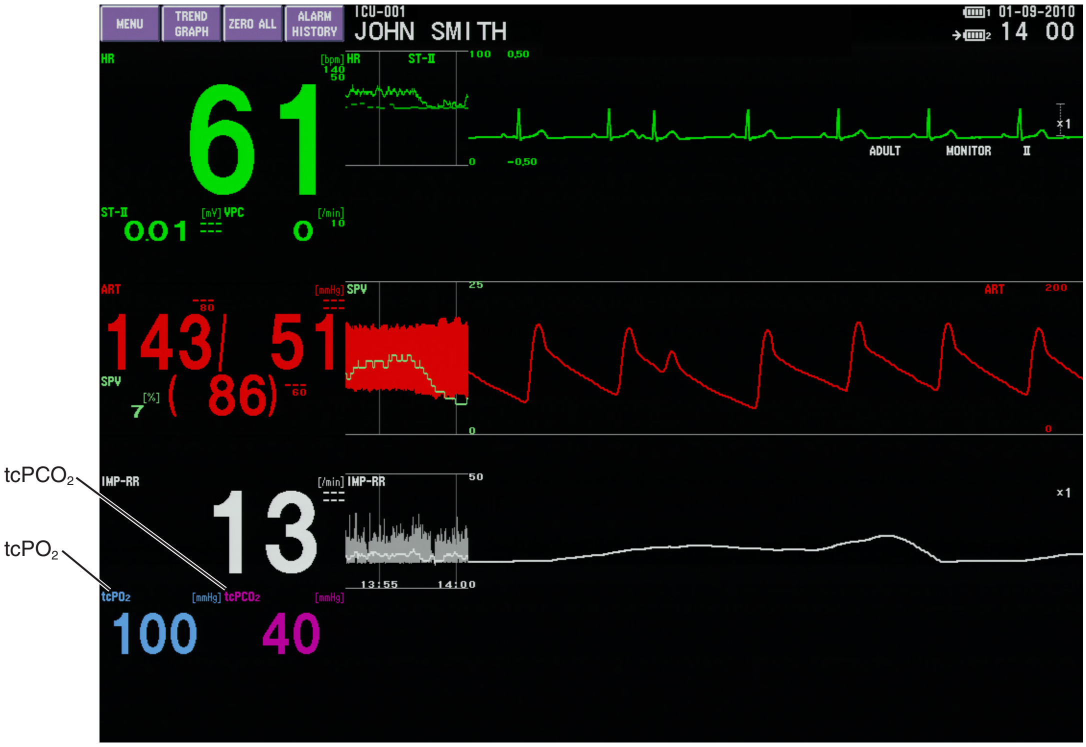
Monitoring $tcPO_2/tcPCO_2$

After completing the preparation, $tcPO_2/tcPCO_2$ data appear on the screen.

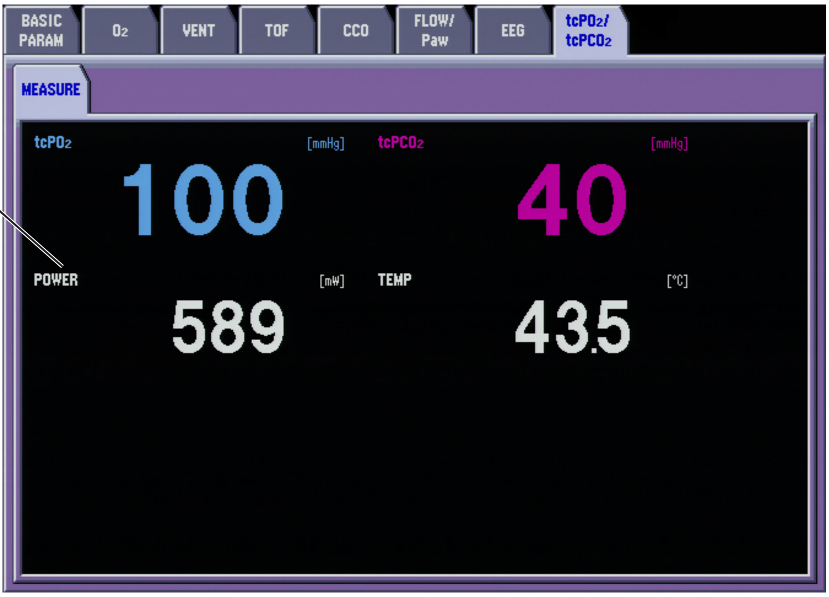
WARNING

When using the transcutaneous monitor, some transcutaneous alarms do not function on the bedside monitor. When the transcutaneous data on the bedside monitor is abnormal or the transcutaneous monitor is giving an alarm, check the messages and data on the transcutaneous monitor.

$tcPO_2/tcPCO_2$ Information on the Home Screen


MENU
TREND GRAPH
ZERO ALL
ALARM HISTORY
ICU-001
JOHN SMITH
01-09-2010
14 00
HR
[bpm]
140
50
61
ST-II
0.01
[mV] VPC
0
[/min]
10
ADULT
MONITOR
II
ART
[mmHg]
143/ 51
SPV
(86)
[%]
7
IMP-RR
[/min]
13
13:55
14:00
tcPCO2
tcPO2
[mmHg]
100
40

$tcPO_2/tcPCO_2$ Information on the $tcPO_2/tcPCO_2$ Window


BASIC PARAM
O2
VENT
TOF
CCO
FLOW/ Paw
EEG
tcPO2/ tcPCO2
MEASURE

tcPO2 [mmHg] 100

tcPCO2 [mmHg] 40

POWER [mW] 589

TEMP [°C] 43.5

Measured values

POWER is displayed only when TCM4 or TCM40 transcutaneous monitor is connected.

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Phone +82 (2) 3273-2310
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The model and serial number of your instrument are identified on the rear or bottom of the unit.
Write the model and serial number in the spaces provided below. Whenever you call your distributor concerning this instrument, mention these two pieces of information for quick and accurate service.

Model ______________________ Serial number ______________________

Your Distributor

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